WFSICCM Seoul 2015 Abstract Book

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This abstract book was supported by the Korean Federation of Science and Technology Societies (KOFST) Grant funded by the Korean Government.

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One Step Further: The Pursuit of Excellence in Critical Care
# August 29 (Sat), 2015

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One Step Further: The Pursuit of Excellence in Critical Care

August 30 (Sun), 2015

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12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS
### August 30 (Sun), 2015

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<td>RM 12</td>
<td>Critical Care in Spinal Cord Injury</td>
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<td>ISF Debates(2): Steroids</td>
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### Session Details

- **ME 09**: Local Hemostatic Dressings for Bleeding Control
- **ME 07**: Sepsis and Septic Shock: Pathophysiology, Recognition, Diagnosis, Treatment, Early and Basic Management

### Time Table

- **09:00-10:20**: Ultrasound in ICU
- **09:00-10:20**: Recent Issues: Sepsis
- **09:00-10:20**: Non-Invasive Continuous Cardiac Output – esCCO
- **09:00-10:20**: Emergency Medicine and Transport
- **09:00-10:20**: Infectious Issues in ICU
- **09:30-11:45**: Electric Impedance Tomography Workshop
- **09:30-11:45**: Ultrasound Hands on Program - Advanced
- **10:45-12:20**: New Techniques in Functional Lung Imaging
- **10:45-12:20**: Protocols and Checklists
- **11:00-12:00**: Nasal High-flow Therapy across the Continuum of Care
- **12:30-13:40**: Step-up Session (4)
- **12:30-13:40**: Step-up Session (5)
- **12:30-13:40**: Step-up Session (6)
- **13:30-17:00**: Ultrasound Hands on Program - Advanced
- **14:00-15:40**: How to Prevent Post-operative Complications?
- **14:00-15:20**: Pulmonary Embolism
- **14:00-16:30**: Non-Invasive Continuous Cardiac Output – esCCO
- **14:00-15:00**: ISF Debates(1): Synthetic Colloids
- **14:00-15:00**: Critical Care in Spinal Cord Injury
- **14:00-16:15**: Electric Impedance Tomography Workshop
- **15:00-16:10**: ISF Debates(2): Steroids
- **15:00-16:10**: The Immunosuppressed ICU Patient
- **16:20-17:30**: ISF Debates(3): Guidelines

### Other Events

- **18:30-21:30**: Faculty Dinner
# September 1 (Tue), 2015

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<tr>
<th>Time</th>
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<td>07:00-07:45</td>
<td>ME 10 Identification and Management of Sepsis</td>
<td>ME 11 Bed-side Assessment of Hemodynamics</td>
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<td>PL 05 Mean Causality in a Resource Limited Country: How to Prepare Care Teams and How to Deliver Appropriate Management</td>
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<td>SY 64 What the Future Critical Care Would Look Like I</td>
<td>SY 66 Hypothermia and Critical Care II</td>
<td>SY 68 Tropical Disease &amp; ICU I</td>
<td>SY 70 WHO and WFSCCM (1): Ebooks</td>
<td>SY 72 Research</td>
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<td>10:30-12:30</td>
<td>SY 65 What the Future Critical Care Would Look Like II</td>
<td>SY 67 Hypothermia and Critical Care II</td>
<td>SY 69 Tropical Disease &amp; ICU II</td>
<td>SY 71 WHO and WFSCCM (2): MERS</td>
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**Exhibition 09:00-14:00**

**Registration 08:00-09:00**
September 1 (Tue), 2015

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<td>07:00-07:45</td>
<td>ME 14 Pressure Controlled Versus Volume Controlled Ventilation</td>
<td>ME 12 Meet the Editor</td>
<td>ME 13 Use of Antiepileptic Drugs in ICU</td>
<td>ME 15 Do Rapid Response Teams Make a Difference: the Evidence</td>
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09:00-10:20

**SY 74** How ICUs Look Different between Countries?

09:00-10:20

**SY 76** Management of Difficult ICU Infection

09:00-10:40

**SY 71** Renal Common Critical Care Problems in ICU

09:00-10:30

**SY 77** Ethics (4) Triage

09:00-10:20

**SY 79** How to Feed in Critically Ill Patients?

10:40-12:10

**SY 75** Significance of ICU Scores in Specific Countries

10:50-12:00

**SU 09** Step-up Session (8)

10:50-12:00

**SU 10** Step-up Session (10)

10:50-12:30

**SY 78** Ethics (5) Organ Donation

10:50-12:10

**SY 80** Protocol-Based Nutrition Therapy in ICU
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Abstract (Invited Faculty)
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Plenary Lecture
CRITICAL CARE MEDICINE: CURRENT AND FUTURE CHALLENGES

Jean-Louis Vincent
Erasme Hospital, Université Libre de Bruxelles, Belgium

Critical care medicine is becoming an increasingly important part of healthcare systems worldwide. We have made considerable progress in our understanding and management of the critically ill patient, but there is still much we do not fully comprehend and we face ongoing challenges as we try and improve outcomes within limited budgets despite growing numbers of admissions. Some key challenges include:

- How to identify patients with infection and sepsis early so that therapies can be started in a timely and appropriate manner.
- How best to monitor and target therapies so that patient resuscitation and management are most effective.
- How to develop new therapies in specific groups of patients.
- How to ensure sufficient ICU beds are available for all patients who need one.
- How to provide continuity of care before and after critical care.
- How to harmonize and coordinate the activities among the different members of the ICU team.
- How to recruit, train and maintain sufficient medical and nursing personnel to cope with the increasing numbers of patients needing intensive care.
- How to provide optimal end-of-life care as the majority of ICU deaths are now preceded by an end-of-life decision.
- How best to assist the development of critical care in countries where the specialty is not or available or poorly developed.

We have come a long way but we have a long way to go as we try to create a system that offers effective and efficient intensive care to all who need it.
THE PROVISION OF CRITICAL CARE MEDICINE: WHERE SHOULD WE BEGIN TO ADDRESS CURRENT GLOBAL DISPARITIES?

J. Christopher Farmer
Mayo Clinic Hospital, United States

This lecture will outline current areas of disparity in access to critical care medicine. Most prominently, infectious diseases and sepsis account for 75% of the critical care-related deaths worldwide. Education, early recognition, and access to basic critical care are significant problems. Trauma and disaster-related serious injury and illness are also associated with limited access to critical care. Outcomes are similarly poor. All of these problems are exacerbated by our inability to consistently answer these questions, what defines an ICU? What is the core knowledge relevant to critical care medicine that must be learned by critical care team members? Who is an intensivist? What critical care priorities do we share between industrialized and resource-limited nations? We must move beyond the assumption that high technology equals high quality critical care. The lecture will address these topics and others.
FROM 1972 TO DATE: MY JOURNEY ON ARDS UNDERSTANDING

Luciano Gattinoni
University of Milan, Italy

The way of ventilating the ARDS lung deeply changed over the last 30 years, primarily due to a better understanding of physiological mechanisms involved in the mechanical ventilation, as heart and lung interaction and generation of ventilator induced lung injury. In the new century, beginning with the National Institute of Health NIH low tidal volume ventilation, a series of therapeutical approaches have been proposed and tested in ARDS, some successful, as prone position and artificial lung support in severe ARDS, some unsuccessful, as high frequency ventilation, and some still questionable and debated, as the use of higher PEEP compared to lower PEEP. At the same time, the mechanisms of ventilation induced lung injury, the primary risk of mechanical ventilation in ARDS, have been furtherly investigated both in its physical and biological components. Recently this bulk of knowledge has been embedded in the Berlin ARDS definition, which pragmatically classifies the degree of severity of the syndrome and, more important, suggests possible treatments scaled to the severity. It is not clear, however, within a certain degree of severity which criteria should guide the possible alternative treatment. As an example, in severe ARDS, prone position, extracorporeal oxygenation should be applied separately or in combination? And, more important, should these techniques be available in every hospital or concentrated in referral centers?
SEPTIC ACUTE KIDNEY INJURY

Rinaldo Bellomo

Melbourne University, Australia

Acute kidney injury (AKI) is a serious condition that affects many ICU patients. The most common causes of AKI in ICU are severe sepsis and septic shock. The mortality of AKI in septic critically ill patients remains high despite our increasing ability to support vital organs. This is partly due to our poor understanding of the pathogenesis of sepsis-induced renal dysfunction.

Through multiple animal experiments involving invasive renal monitoring and magnetic resonance work in septic animals and humans, we have developed new concepts to explain the pathogenesis of septic AKI, which challenge previously held dogma.

Throughout the past half century, septic AKI has essentially been considered secondary to tubular injury, which, in turn, has been considered secondary to renal ischemia. However, the hallmark of septic AKI and AKI in general is the loss of glomerular filtration rate (GFR). It would seem logical, therefore, to focus on the glomerulus in trying to understand why such loss of GFR occurs. Our experimental observations suggest that, at least in the initial phases of septic AKI, profound changes occur which involve glomerular haemodynamics and lead to loss of GFR. These observations suggest that changes in the vasoconstrictor tone of both the afferent and efferent arterioles are an important component of the pathogenesis of septic. They also suggest that intra-renal shunting may be an important mechanism for the loss of GFR. The dissociation seen between blood flow and function in animal experiments was confirmed in human studies. The mechanisms for such dissociation remain unclear. However, immunological mechanisms related to the innate immune system may contribute to them. It is also possible that the loss of renal function in early sepsis represents a protective mechanism which minimized renal injury. In deed on histological assessment up to 48 hours, there is no evidence of major structural injury despite major loss of function.

The ischemia paradigm for septic AKI is not sustained by our experiments over more than a decade. In fact global renal blood is increased in typical septic AKI. Despite such increase GFR decreases. This dissociation between global flow and function suggests specific change in glomerular and peri-glomerular haemodynamics.
MASS CASUALTY IN A RESOURCE-LIMITED COUNTRY: HOW TO PREPARE CARE TEAMS AND HOW TO DELIVER APPROPRIATE MANAGEMENT

Bin Du
Peking Union Medical College Hospital, China

Mass casualty event is any incident in which emergency medical services resources, such as personnel and equipment, are overwhelmed by the number and severity of casualties. Mass casualty events that occur frequently worldwide may include bioterrorism, chemical emergencies, radiation emergencies, and natural disasters. The incident characteristics vary across hazards and even within a specific hazard type, such as sudden versus slow onset, insidious versus obvious onset, short duration versus prolonged incidents, terrorism and other fear-generating hazards. These characteristics should be considered when assessing and predicting the severity of the hazards, as well as planning the delivery of medical care to the affected area. In addition, nature of the hazards may well predict the number and type of casualties expected, which may result in better preparedness (both psychologically and materially).

Mass casualty events, especially natural disasters, often leave behind them significant infrastructure damages, and hospitals in the affected area may be nonfunctional. Moreover, definitive medical care at the rescue scene is not only very difficult, but also less likely to be self-sustainable due to difficulty of continuous logistic support. Consequently, the decision of victim evacuation from affected areas after triage is mandatory. However, the efficiency of evacuation might exhibit a significant impact on the patient inflow, which might be overwhelming, into hospitals in unaffected areas.

Lack of human resources is another important issue. Local medical personnel might be unavailable due to injury, the need to care for families, and psychological stress. Under such circumstances, a continuous supply of foreign aid healthcare providers might help to close the gap by providing seamless health care service to those who remain at the affected area.
ADVANCING CRITICAL CARE NURSING

Ruth Kleinpell
Rush University College of Nursing, United States

Critical care continues to develop globally, and opportunities for critical care nurses are expanding worldwide due to the need for expert nursing care to assist in the management of acute and critically ill patients. While growth in the role is occurring, monitoring trends, changes, and challenges in critical care nursing is required in order to support and promote the advancement of global critical care nursing. However, reports from critical care nurses in various practice settings identify similar role challenges, including adequate staffing, access to supplies and equipment, and ongoing educational needs. Addressing these challenges is requisite to ensuring that optimal nursing care is provided to promote best outcomes for critical care patients.

The World Federation of Critical Care Nurses (WFCCN), an international organization with more than 40 country members, represents over 600,000 critical care nurses worldwide. The WFCCN defines critical care nursing as the care and treatment of the critically ill patient and their family regardless of the environment. WFCCN has conducted an international survey every 4 years for the past 16 years to examine the activities and concerns of critical care nurses and professional critical care nursing organizations around the world, and to identify expectations held of nursing leaders and policy makers to help address the concerns. The WFCCN 4th international survey of critical care nursing organizations was just completed in 2014. Prior studies were conducted in 2001, 2005, and 2009, and have provided the foundation for WFCCN strategic planning and helped to encourage and focus the activities of its member associations and other nursing leaders and policy makers around the world.

Responses were received from 59 countries with critical care nursing organizations, or known critical care nursing leaders. Consistent with the results of the 3 prior international surveys, staffing levels, working conditions, access to quality education programs, wages, and the need for practice guidelines and competencies have consistently emerged as important issues in critical care nursing. Respondents’ views about the most important activities of national critical care nursing organizations were also consistent: professional representation; national conferences; standards for educational programs; practice standards and guidelines; workshops and educational forums. Resources that were identified to be of most value were educationally focused, including conferences, newsletters, journals and internet based resources; and practice standards and guidelines.

The surveys have collectively informed WFCCN priorities, activities, publications and presentations through international journals, conferences and policy documents. Educational priorities at international conferences and forums and development of international guidelines on sepsis, online learning, post graduate education programs and workforce planning have all been inspired by these surveys, as well as many regional and local initiatives undertaken by critical care nursing organizations throughout the world. This session will provide an overview of additional results, including implications for critical care nursing practice, policy and research.
ADVANCES IN PIC - WHAT DIFFERENCES HAVE WE MADE IN THE LAST DECADES?

Sunit Singhi
Postgraduate Institute of Medical Education & Research (PGIMER), India

The pediatric ICU and the specialty of pediatric critical care medicine, have changed markedly and progressively in the last decade to contribute to the improved outcomes of children. Much of the progress can be attributed to the advancement in biomedical sciences, biomedical engineering, imaging, information technology, better understanding of pathophysiology of critical illness and development of multidisciplinary teams. Perhaps the most obvious of changes within the PICU in the last decade has been in technology and equipments. The bulky machines have become smaller and more mobile. Many like pulse oximetry and ETCO2 have become standard of care while various technologies that support failing organs like HFOV, CRRT, Left ventricular assist devices and ECMO are common place and continuously evolving. Integration of information technology has simplified continuous monitoring of multiple parameters and also enabled storage of voluminous data electronically that is readily available at the bedside. Advances in the field of fluid therapy have been prominent. A significant change has been the steady shift towards isotonic fluids for maintenance therapy in critically ill children and the realization of risks associated with positive fluid balance. Fluid overload has been proven to worsen organ failures and impact outcome negatively. Perhaps avoiding ‘overdoing’ or limiting it to what is just adequate has become the norm with many PICU interventions; let that be glucose control, sedation strategies, low tidal volume ventilation or restrictive blood transfusion. Sepsis in pediatric critical care has received much needed global attention with a redefined outlook on our understanding of infection. Structured guidelines that are now more inclusive emphasizing first dose of antibiotics and early and goal directed administration of fluids and vasoactive agents have gone a long way in saving lives. Significant developments in the field of neurocritical care have taken place in form of multimodal neuro-monitoring, which include intracranial pressure, brain electrophysiology, brain microdialysis and cerebral blood flow. This has led to evolution of therapeutic regimens that focus on cerebral perfusion, oxygenation and metabolic parameters as end points. Newer TBI guidelines and recent studies on CNS infections have positively influenced the way we treat neurologically ill children. Hypertonic saline is gradually finding favors over mannitol as the principal osmotherapy. The progress in the process of deliver of care has addressed the PICU organizational issues, led to family involvement and family-centric care and more informed views on ethics and end of life care. Continuous step by step progress has been made on Safety and Quality with introduction of safety checklists, care bundles, critical incident reporting and computer-assisted decision making and order-entry. Pediatric intensivists have also moved outside the walls of PICU leading a rapid response team or lending their expertise to far away places with telemedicine. Thus, Pediatric critical care has grown steadily in the last decade within and beyond the walls of PICUs. However many challenges remain, those related to meeting expanding cost and patient numbers with limited resources to those facilitating myocardial and neuronal regeneration targeting stem cells and molecular mechanisms.
QUALITY IMPROVEMENT IN TRAUMA AND CRITICAL CARE

Raul Coimbra
University of California San Diego Health System, United States

Measuring the results of what we do in the clinical setting includes significant date collection and analyses. By doing so we may change outcomes, more people may survive, team performance improves, and fewer errors are made over time.

Measuring quality in the ICU is a complex process because the ultimate desirable outcome, survival, is not only dependent on overall quality of care, but also closely related to the underlying disease process leading to ICU admission.

Quality assurance and performance improvement in a surgical/trauma ICU are complex processes requiring ongoing identification of outcome measures or performance indicators, data collection and analysis, and the development of action plans to correct deficiencies and subsequent monitoring of the performance (outcome) measures. The underlying goal of delivering high-quality care also depends, to a significant degree, on specialization (critical care specialists), provider education and training, and good communication and collaborative interaction between specialty and ancillary services.

Similarly to any process in industry, the creation of a continuous quality improvement in the Intensive Care Unit (ICU) includes 4 practical steps: 1) Development, 2) Implementation, 3) Evaluation and 4) Sustainability.

Any program addressing quality of health care has to follow several principles: It has to be safe, timely, effective, equitable and patient-centered. Because of this, there is much confusion in measuring quality and developing a Continuous Quality Improvement (CQI) program in the ICU because on the inherent association between quality and patient safety. Although the current tendency is to bundle these two important aspects of care (e.g. performance improvement and patient safety [PIPS] programs), it may be wise to separate them at least in the beginning of the development of the CQI program to better frame and define the true indicators related to process of care which can be modified over time.

Existing critical care quality assurance programs have used a variety of clinical indicators or filters as a measure of the quality of care. When creating a CQI program for ICUs quality of care has to be divided into three components: Structure, Process and Outcome, each with its own quality indicators. Structure is defined as the way we organize care. Process is what we do or fail to do. Outcomes are the results we achieve.

Examples of quality of care measures related to the structure of the ICU include intensivist-lead rounding team, open vs. closed units, multidisciplinary rounds, pre-established evidence-based computerized order sets, etc. Possible quality of care measures related to process include DVT prophylaxis, VAP bundle, Central Line Insertion bundle, surviving sepsis campaign guidelines, Ventilator weaning, sedation and analgesia, low tidal volume ventilation, early enteral nutrition, transfusion thresholds, just to name a few. Examples of outcome measures include unplanned extubation, bloodstream infection rate, VAP rate, adverse drug events, patient satisfaction, family satisfaction, unexpected ICU admission, ICU LOS, and mortality.
Many of the factors which are related to poor health and childhood morbidity and mortality include: maternal education; access to clean water and adequate sanitation; access to food and nutrition; urbanisation and socioeconomic conditions and appropriate immunization and access to basic healthcare services.

With implementation of programmes addressing preventive health management, access to healthcare and to some extent health behaviours there has been a dramatic improvement in the global under-5 mortality rate over the last decade with recent estimates showing a decline in the number of deaths from more than 12 million in 1990 to 6.9 million in 2011.

An infant or child who suffers a life threatening illness or injury requires management that provides for: easy 24/7 access to healthcare facilities that provide care for children; early recognition of life threatening or potentially life threatening illness or injury; appropriate and effective initial intervention and therapy; safe transport to facilities that are adequately equipped to provide advanced therapy; access to emergency care and if necessary to intensive care; access to the multiple disciplines that are required to support the care of child with a life-threatening illness or injury; access to rehabilitative facilities and finally ongoing support once back in their own home.

Thus critical care in resource-poor settings is imperative. Important points include: intensive care in the broadest sense is not defined by the presence of expensive technology and substantial improvements in care can be achieved by the application of relatively simple technology (e.g. for oxygen provision) and by nursing monitoring; as reviewed by Nolan et al, a substantial proportion of children who are seen at primary care facilities require referral to a hospital (90% with one of 5 common conditions that are amenable to hospital care if referral is timely); in countries such as Papua New Guinea a substantial proportion of the deaths in the community actually occur in hospitals and could be averted by relatively simple interventions; failure of health systems to provide rescue actually undermines the credibility of the overall system. In Papua New Guinea provision of oxygen systems for childhood pneumonia produced a 35% reduction in mortality in that group of patients at a cost of $51 per patient treated. Allocation of even a relatively small proportion of beds in the hospital system in many countries to children have the potential to make a tremendous difference.

Critically ill children in LMICs faces great obstacles in accessing critical care services. However, with innovative approaches critical care can be afforded in many cases. An infusion of financial resources coupled with resourceful caregivers and policy makers is needed.
OPTIMIZING NEUROCRITICAL CARE ACROSS DIFFERENT HEALTHCARE DELIVERY SYSTEMS

J. Claude Hemphill  
*University of California, San Francisco, United States*

Neurocritical care is a branch of critical care that has experienced substantial growth and development over the past two decades. Advances in the monitoring and treatment of patients with traumatic brain injury, stroke, hypoxic-ischemic encephalopathy, status epilepticus, and central nervous system infections have highlighted the value of new approaches to the care of these patients. Although early experience in organized neurocritical care derived from a small number of highly-specialized and technologically advanced academic centers, focus has shifted to developing ways to expand the tools and expertise of neurocritical care more broadly throughout the world. Numerous organizational models for neurocritical care delivery exist throughout the world and there are proponents of each of these. Likewise, specific protocols and use of technology also vary. The emphasis of this talk will be on distilling the elements that have led to the success of neurocritical care from a patient-centered focus and charting a course for how these can optimally delivered while taking into account variations in provider education and training, availability of technology, financial and organizational pressures, and limitations in resources.
Meet the Expert
OPTIMIZING CULTURE CHANGE TO IMPROVE PATIENT OUTCOMES

E. Wesley Ely

Vanderbilt University Medical Center and VA GRECC, United States

It is imperative societally and as healthcare professional that we increasingly focus on the public health problem of acute and long-term brain dysfunction amongst critically ill patients during and following their illness. Delirium is an extremely common organ dysfunction and a strong independent predictor of length of stay, cost of care, death, and long-term cognitive impairment that resembles an acquired dementia of the severity of Alzheimer's disease or traumatic brain injury. Numerous modifiable causes have been identified (including delirium duration) and workers all over the world are attempting to reduce the onset and duration of delirium and both prevent and manage the long-term acquired dementialike illness that ICU survivors suffer from so severely. It is high time that medical interventions designed to improve neurological recovery are subjected to appropriately designed and robustly powered randomized controlled trials.
WHY NOT MEASURE BLOOD VOLUME TO DETERMINE THE ENDPOINT OF THE FLUID AND RED CELL RESUSCITATION?

Mihae Yu  
*University of Hawai'i School of Medicine & the Queen's Medical Center, United States*

The first principle of shock resuscitation irrespective of etiology is to achieve euvoemia. Major problems in clinical medicine are: 1) the endpoint of fluid and blood resuscitation is determined by surrogate markers instead of measuring intravascular volume and red cell volume, and 2) most ICUs do not utilize tissue perfusion monitors which would allow titration of oxygen delivery (DO2) to meet tissue demands. Problems associated with fluid resuscitation to static pressures such as central venous pressure (CVP) and pulmonary artery occlusion pressures (PAOP), are well recognized. There has been increasing interest in variability in the cardiovascular system (Stroke volume variation, pulse pressure variation) to determine cardiac responsiveness to fluid infusion but whether this impacts outcome is not known. The best estimate of circulating intravascular volume should be to measure volume which has historically been technically difficult. The bedside measurement of blood volume has been simplified by a semi-automated technique for measuring circulating blood volume (BVA-100, Daxor, NY) using I-131 tagged albumin. This allows for measurement of plasma volume, red cell volume, and total circulating blood volume. We present data on: 1) discrepancy between clinical judgment and the measured blood volume, 2) and how using blood volume analysis to guide fluid and red cell treatment may impact mortality.
THE FUTURE OF THE TREATMENT OF ACUTE BRAIN INJURY

Gene Sung

University of Southern California, United States

The last frontier of medical research is acute brain injury. Almost any organ of the body can now be fixed or replaced, except the central nervous system. And it becomes increasingly clear that the much of the benefit of treatment lies in intervention in the early, acute stages of injury.

The whole field of modern neurocritical care has rapidly developed to deal with these issues and all critical care practitioners, not just neurocritical care specialists, are affected by new developments in this area.

What treatments exist now and what treatments will be developed for acute brain injury? We will discuss these topics and how the principles of the brain injury process can be used to develop new therapies and targets, as well as development of tools to better target the problems to be treated.
CASE DISCUSSIONS: TRAUMATIC HEAD INJURY AND CNS INFECTIONS

Sunit Singhi
Postgraduate Institute of Medical Education & Research (PGIMER), India

This session will discuss two cases to highlight important issues in the management of TBI and CNS infections. First is a 4 year old male, who presented to Pediatric Emergency department (ED) with history of a fall from 1st floor of a construction site 2 hours ago. He cried excessively after the fall and then became unconscious. Thirty minutes after the fall he had one episode of generalized tonic clonic seizure, which lasted for 5 minutes. In emergency department, an initial assessment revealed obstructed airway, normal hemodynamic status and modified-Glasgow Coma Scale Score (GCS) of 6, (E1M3V2,). He was posturing and had unequal pupils. After stabilizing measures and treatment his GCS was E1M1VT, pupils 2mm equal and reacting. The discussion will focus on steps in initial evaluation and stabilizing measures, neurosurgical consult, indications for imaging and CT versus MRI, and when is intracranial pressure monitoring required. Evidence based therapeutic measures for raised ICP, end points of ICP monitoring, targets for cerebral perfusion pressure and whether ICP monitoring improves the outcome, and role of decompressive craniectomy in children with refractory raised ICP will also be discussed.

Second is a case of a 4 year old boy, who presented with fever, headache and vomiting for 3 days, followed by a left focal convulsion prior to arrival in hospital. On arrival in ED, he had a generalised convulsion. The discussion will bring up issues in initial assessment and approach, stabilization measures, identification of clinical features of raised ICP, initial management of raised ICP, use of empiric antibiotics and or antivirals (acyclovir) after stabilization, when to perform lumbar puncture (LP) and when to withhold LP and obtain Neuroimaging (CT versus MRI), indications for transfer to PICU, current role of dexamethasone in bacterial meningitis, osmotherapy in acute CNS infection (Hypertonic saline vs. Mannitol 20%), role of invasive ICP monitoring, management goals, and outcomes.
INDIRECT CALORIMETRY IN THE ICU

Pierre Singer
Rabin Medical Center, Israel

According to Nutrition Day ICU audit, most of the calorie prescriptions in the world are around 1,500 kcal/day regardless of weight or BMI, illness or stage in the disease. Predictive equations are used largely but their accuracy is very low. It is recognize that bedside indirect calorimetry technique is providing the most accurate assessment of energy requirements in most clinical conditions. It improves the accuracy of prescription by more than 40%, avoiding under and over nutrition. This seems to be of increasing importance, since in addition to observational studies showing that calorie deficit is associated with worse outcome, prospective randomized studies using indirect calorimetry to target energy goals succeed to improve clinical outcome (1, 2). Recent recommendations from large European nutritional societies are recommending the use of indirect calorimetry when available. When used appropriately, this good clinical practice may improve the nutritional support of the critically ill patients.

Technical limitations exist and indirect calorimetry cannot be used when a patient is ventilated with FIO2 > .6, with nitric oxide or PEEP higher than 10, when chest air drainage is present or if the patient is receiving CRRT. In these situations, the most adequate predictive equation should be used so that calorie prescription can be achieved until measurement is available when the patient's condition allows a precise measurement.

When indirect calorimetry is available, use it!
NURSING CARE TO REDUCE CLA-BSI AND CA-UTI AND VAP/HAP

Kathleen Vollman
ADVANCING NURSING LLC, United States

Health-care acquired infections (HAI) are the most frequent result of unsafe care worldwide and a preventable injury. The rate of device use in the US is similar in volume to the international community but device related infections are much higher in INICCC which comprises 43 countries in Latin America, Asia, Africa and Europe. The use of bundle technology has provided direction on how to prevent HAIs and the spread of resistant microorganisms.

This session will explore modes of transmission in order to outline a strategy for source control. This session will provide an in-depth look at nursing care practices that impact outcomes including, prevention practices for eliminating CAUTIs and CLA-BSIs as well as ventilator and hospital acquire pneumonia. Numerous studies have shown that education and skill building is not enough to effect long lasting change. Multimodal strategies must be utilized that look specifically at the resources/devices to help deliver the care and the systems or process design around the care to make it easy for the clinician to achieve the practice in a complex working environment. A focus on development of evidence-based care practices and protocols and the examination of resources and systems that support source control and reduce transmission will be discussed.

We need to take ownership of one of the major roles of a professional registered nurse: prevent the spread of resistant microorganisms and the development of health care acquired infections.
SEPSIS AND SEPTIC SHOCK (EARLY RECOGNITION AND TREATMENT, THERAPEUTIC GOALS AND BASICS MANAGEMENT)

Niranjan "Tex" Kissoon

British Columbia Children's Hospital (BCCH), Canada
EARLY MOBILIZATION

Steve Webb

Royal Perth Hospital, Australia
LOCAL HEMOSTATIC DRESSINGS FOR BLEEDING CONTROL

Peter Rhee
The University of Arizona Medical Center, United States

Local hemostatic dressings have had an explosion in the surgical market. The hemostatic agents are categorized into flowables and non-flowables. They are also categorized into active and passive agents. This talk will focus on local hemostatic agents that are non-flowable and active. While any foreign body in contact with blood will activate the coagulation cascade there are specific chemicals that will activate the coagulation cascade. These chemicals have been applied to various dressings and are useful to stop bleeding from external wounds. The passive agents without additional chemicals are generally dissolvable material such as cellulose that will activate the coagulation cascade and have the advantage of being biodegradable and can thus be left in the body. Examples of this type of hemostatic agents include surgicel and gelfoam. There is significant experience with these materials in vascular surgery and general surgery. However these products are not generally used in the pre-hospital settings. There are now active local hemostatic agents that are available and have been tested in the military setting. The US military now advocates the use of various local hemostatic agents and have them available for use in the battlefield setting. This session will go over many of the available products in the market, discuss how they work, if the work and the appropriate uses and failures. These products are now widely available in the civilian prehospital setting to be used by paramedics and first line responders such as police and fireman. The wide spread use of these products by bystanders in the civilian setting will also be discussed as there may be need for these products in mass casualties and disaster settings.
IDENTIFICATION AND MANAGEMENT OF SEPSIS

Mitchell Levy
Rhode Island Hospital/Brown Medical School, United States
BED-SIDE ASSESSMENT OF HEMODYNAMICS

Jukka Takala
University Hospital Bern, Inselspital, Switzerland

The clinical assessment at the bed side is the basis of all hemodynamic evaluations. No technical monitoring or diagnostic tool can replace the systematic clinical assessment of circulation, and all results from monitoring and diagnostic devices must be put into context with the clinical findings. Hemodynamic stability can be verified based on clinical judgement and careful clinical assessment of the patient. A patient with normal mental state, without obvious, clinically relevant hypotension, normal capillary perfusion and refill in the periphery and warm skin temperature, normal central and peripheral venous filling, with ongoing diuresis, and without hyperlactatemia is likely to be stable. A patient who is obviously ill and do not fill one or several of the clinical criteria for stability should be considered possibly unstable. Such signs of inadequate hemodynamics as peripheral vasoconstriction and/or decreased venous filling, hypotension or symptomatic decrease in blood pressure, signs of cerebral or coronary hypoperfusion, oliguria, and acute reduction in urinary output relate to blood pressure decrease can all be observed in systematic clinical examination. Empty veins and peripheral vasoconstriction signal for hypovolemia, and treatment of hypovolemia should be treated without delay, while the search for cause must start in parallel. Dyspneic breathing and full central veins suggest an intrathoracic cause of hemodynamic instability. Decreased level of consciousness related to hemodynamic instability should prompt the suspicion of sepsis, very severe low cardiac output. The systematic assessment of the patient can be done in less than 60 seconds, and repeated as often as necessary.
MEET THE EDITOR

Philip Lumb
Keck School of Medicine of the University of Southern California, United States

Objectives:

1. To provide prospective authors an opportunity to meet and interact with the Editor-in-Chief of the Journal of Critical Care, the official Journal of the World Federation of Societies of Intensive and Critical Care Medicine (WFSICCM) and the Society for Complex Acute Illness (SCAI)

2. To discuss manuscript preparation and submission to JCC and other publications

3. To explain the peer review process including
   - Authors responsibilities during submission and manuscript preparation
   - Opportunities when suggesting peer reviewers; helpful tips

4. When a manuscript is returned
   - Accept
   - Revise
   - Revise with significant changes / Reject and Resubmit
   - Reject

   What do I do now? What do the decisions mean relative to future acceptance? What does the editor mean?

5. Revision

   Its all about telling the story; check for:
   - Hypothesis
   - Abstract
   - Introduction
   - Methods
     - Ensure statistical and procedural accuracy
     - Identify if continuation of prior study or subset analysis
   - Results
   - Conclusions
   - Discussion

6. Resubmission

7. Decision

8. Final submission
9. On-Line Availability Versus In Print publishing

Discussion:
Journal of Critical Care
1. Publication statistics
2. Subscriptions
The purpose of the session is to provide an opportunity for prospective and current authors to meet the Editor-in-Chief and ask questions in relation to publishing guidelines and tips for creating manuscripts that are compelling and most likely to be reviewed favorably.
USE OF ANTIEPILEPTIC DRUGS IN ICU

Byungin Lee
Yonsei University College of Medicine, Republic of Korea

Seizures are common clinical manifestation in patients suffering from serious neurological and medical diseases. The incidence of seizures in medical-ICU ranges from 3.3% to 34%. Bleck et al. (1993) reported that 12.8% (217 patients) of 1,758 patients admitted to the medical-ICU developed neurological complications with seizures being the second most common neurological complication (28.1%) following the metabolic encephalopathy (28.4%). The incidence of seizures is even higher in patients being treated at the Neurological ICU, especially in patients with deeply obtunded or coma, which are often associated with electrical ictal discharges without any clinical manifestations of seizures. For example, 34% of patients who were admitted to the Neuro-ICU and had continuous-EEG recording showed nonconvulsive seizures (NCS) on continuous-EEG, and 76% of them were in non-convulsive status epilepticus (NCSE). In addition, most neurosurgeons routinely prescribe AEDs in cases of tumor surgery or patients with subarachnoid hemorrhage for the purpose of seizure prevention. Therefore, optimal AEDs therapy is an important clinical issue for management of patients at neuro-ICU settings.

AEDs therapy at neuro-ICU is considered for (1) Prophylactic therapy of seizures in patients with serious CNS insults, (2) control of isolated or recurrent seizures, and (3) control of status epilepticus. Prophylactic AEDs therapy in patients with acute CNS insults has been found effective only for prevention of acute symptomatic (or early) seizures without any efficacy on the prevention of late seizures (or epilepsy). Therefore, prophylactic AEDs use is indicated only at the acute clinical setting for the prevention of early seizures, usually during the first 1-week after the insult. AEDs therapy for the control of isolated or recurrent seizures at ICU usually follows the principles of AEDs therapy for patients with epilepsy. Accurate diagnosis of seizure types and etiology is crucial for the choice of AEDs as well as the duration of AEDs therapy. Choice of AEDs should be individualized and require careful assessment of pharmacological profiles of individual drugs. Drugs having significant potential for drug- interactions should be avoided because patients at ICU settings are usually under many different classes of medications. Drugs having various formularies, e.g., intravenous or syrups, etc., and being titrated rapidly are preferred at the ICU-setting. Other considerations may include lack of serious adverse effects, non-sedatives, spectrum of actions, drug metabolism, and safety for long-term use. For management of SE, a protocol based AEDs therapy should be exercised for the rapid control of SE, however, there are no treatment guidelines available yet for NCSE at ICU settings.
PRESSURE CONTROLLED VERSUS VOLUME CONTROLLED VENTILATION

Laurent Brochard

St. Michael’s Hospital, Canada

A mechanical breath can be delivered targeting a volume or a flow, like in volume controlled (VC) breaths, or targeting a given pressure like in pressure controlled (PC) breaths. Though this simple approach can be sophisticated with multiple refinements, this separation constitutes the central classification of the different modes of ventilation. There is no intrinsic reason to say that one type of breath is better than the other but it might be emphasized that they work with different principles, which has important physiological and clinical consequences. These sometimes complex physiological differences are often misunderstood, which probably sometimes lead to suboptimal or inappropriate clinical management. Key aspects of settings like the importance of peak-flow adjustment for volume controlled breaths or the meaning of the peak airway pressure during pressure controlled breaths are often ignored. The impact of intrinsic PEEP is also different between the two modes. A main difference is the possibility to control transpulmonary pressure swings in volume control, whereas pressure control allow the patient to increase volume and therefore does not control transpulmonary pressure. A comparison of the results of the two main modes using these breaths, i.e. VC-continuous mandatory ventilation and PC-continuous mandatory ventilation, was performed in the published literature retrieved through a systematic review process incorporating physiological criteria to select the studies. Physiological outcomes like mechanics, gas exchange or work of breathing could not evidence any difference. The assessment of clinical outcomes are based on a few studies in which the precise description of the settings is usually not given, and show no differences in outcomes. The most important to date for the clinician is therefore to better understand the physiological principles in order to adapt the choice of the mode and the settings individually.
DO RAPID RESPONSE TEAMS MAKE A DIFFERENCE: THE EVIDENCE

Rinaldo Bellomo
Melbourne University, Australia

Since the introduction of rapid response teams (RRTs), there has been debate and controversy about the efficacy of such interventions. Initial studies were single center and before-and after in design and provided preliminary evidence of an effect especially in terms of reducing cardiac arrests and complications in surgical patients. However, even though such before-and-after studies have now been reported from multiple centres and multiple countries, they can only establish what a RRT can do, rather than what it will reliably do. This, however, is not surprising as this intervention is not a drug but rather an intensely logistic, anthropological, social and system and people-dependent intervention. Thus, its efficacy depends not only on the intervention itself but very much on the way it is implemented and the commitment of the team itself, the institution and the care-givers who are responsible for activating the team. Nonetheless, the MERIT trial aimed to address the efficacy of RRTs by conducting a cluster randomized controlled trial. Although on simplistic straight comparison analysis, the MERI trial did not show a significant reduction in adverse outcomes, multiple subsequent analyses have shown that, even in such a trial, the introduction of RRTs induced profound changes in patient outcomes, patient management and end-of life care which all improved the quality of management acutely ill patients. Subsequent meta-analyses have confirmed an effect on the prevention of cardiac arrest and offer clear support for the introduction and systematic application of rapid response systems.
THE FRONT END AND BACK END IN ICU

Yoshihito Ujike
Kawasaki Medical School, Japan

We have treated very seriously ill patients in ICU for a long time. We made our maximum effort to save the patients’ lives with possible treatment strategies, mechanical ventilation, ECMO, IABP, CRRT, etc. Advances in critical care have rescued many who would have previously died. I believe the treatments of the front end in ICU were successfully progressed in past 40 years.

However, many survivors suffer from severe symptoms of disease processes acquired or accelerated during the ICU stay. These symptoms are ICU delirium and ICU-acquired weakness that affect on the ICU outcome and on the post-ICU quality and quantity of life. ICU delirium is a frequent complication of critical care, developing in approximately two-thirds of critically ill patients. Importantly, a substantial proportion of patients acquire additional risk factors while in the ICU that independently predict delirium incidence or amplify preexisting risk factors. Some of these iatrogenic risk factors are modifiable, including both pharmacologic and non-pharmacologic factors. For example, multiple studies show the relationship between ICU delirium and the use and management of potent sedative and analgesic agents, with an increased risk of delirium with benzodiazepines. Non-pharmacologic examples include immobility in the ICU and environmental factors (eg, lack of access to daylight) that are both amenable to intervention.

ICU-acquired weakness is the acute onset of neuromuscular/functional impairment in the critically ill for which there is no plausible etiology other than critical illness. Generalized weakness impairs ventilator weaning and functional mobility. Acute morbidities (eg, acute physiology score, hyperglycemia) and medications (eg, corticosteroid use) are reported risk factors for this condition. An additional key risk factor for ICU-acquired weakness is the duration of mechanical ventilation experienced by patients, with weakness occurring in up to 58% of patients who receive mechanical ventilation for at least 7 days.

Unfortunately, the treatments of the back end in ICU remain still immature. In my lecture, I will talk about a ABCDEs bundle with great potential to reduce the burden of ICU-acquired delirium and weakness.

I strongly believe both of treatments at front end and at back end are important for the quality of ICU.
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Symposium
Acute Respiratory Distress Syndrome has been described as a form of acute hypoxemic respiratory failure in 1967. Since then attention has been focused on the clinical problems posed by severe hypoxemia and by the need to overcome or correct it.

The main cause of hypoxemia in ARDS is certainly intrapulmonary shunt \( (Q_s/Q_t) \), i.e. perfusion of unventilated air spaces. Shunt is the result of atelectasis, distal airway collapse, or alveolar occupation by inflammatory debris and cells. It is important to take into account that, at variance with lungs with very low shunt effect (i.e. \( Q_s/Q_t \leq 10\% \)) in ARDS mixed venous oxygen saturation becomes a major determinant of arterial oxygenation. While in normal subjects arterial saturation is almost independent from cardiac output, in ARDS an important proportion of mixed venous blood \( (Q_s, \text{from the non-ventilated compartment}) \) mixes with the ideal oxygenated blood (from the ventilated compartment) to make the arterial blood. As an example, when \( Q_s/Q_t \) is 50\%, 50\% of the blood making up the arterial blood will be the mixed venous one. By this mechanism the effect of a drop in mixed venous saturation will be reflected in the arterial saturation by a drop proportional to the size of \( Q_s/Q_t \).

We normally correct hypoxemia by increasing \( \text{FiO}_2 \), but this manoeuver might contribute to increasing atelectasis, at least for the proportion of hypoxemia generated by low VA/Q areas (reabsorption atelectasis) which will be converted into true intrapulmonary shunt.

Moreover, the concept of permissive hypoxemia, though attractive in many ways, is difficult to apply in clinical conditions, since it is very difficult to establish a minimum safe level of \( \text{PaO}_2 \).

In the last 20 years we learned how smaller tidal volumes contribute to improved survival, probably by minimizing ventilator induced lung injury (VILI). While this is certainly true, it is also true that for most ARDS patients minute ventilation is two to three times the normal ventilation. This very high need for minute ventilation is due to a very high dead space (\( V_d/V_t \)), mostly related to alveolar dead space (ventilation of non-perfused lung regions). Alveolar dead space has been shown to be associated with microvascular thrombosis and/or obstruction, in turn reflected also by a high pulmonary artery pressure and resistance. Studies have shown mortality to be tightly related to both \( V_d/V_t \) and pulmonary artery pressure/resistance. Experimental models suggest that high minute ventilation is conducive to VILI, and that ventilation of underperfused or nonperfused regions results in hemorrhagic pulmonary edema.

We can conclude that ARDS is not just a hypoxemic syndrome, but it is indeed characterized by a severely altered capability of eliminating \( \text{CO}_2 \) through the ventilation of the natural lung, and that extracorporeal \( \text{CO}_2 \) removal might have a role in decreasing VILI risk in ARDS patients.
VENTILATOR-INDUCED LUNG INJURY

William Hurford

University of Cincinnati, United States

Regional lung mechanics in patients with ARDS vary considerably. Areas with relatively normal compliance may be accompanied by areas of dense consolidation. The forces associated with lung inflation and deflation therefore vary considerably within the lung and can be associated with considerable shear stress. Such stresses can arise with either region lung over-inflation (volutrauma) or the repetitive re-opening and closing of atelectatic lung (atelectrauma). Alveolar epithelial and endothelial damage can result, which in turn can elicit a systemic inflammatory response (biotrauma). Clinically, patterns of mechanical ventilation that are characterized by large tidal volumes (> 8 ml/kg predicted body weight) or high airway pressures have been shown to worsen lung injury and outcome of patients with ARDS. Strategies that focus on limiting tidal volumes and using of positive end expiratory pressure (PEEP) and/or recruitment maneuvers to reduce lung heterogeneity and atelectasis appear to reduce the occurrence of ventilator-induced lung injury and are being increasingly adopted in clinical practice.
INDIVIDUALIZATION OF VENTILATION FOR ARDS

Laurent Brochard

St. Michael’s Hospital, Canada

Solid pathophysiological rationale and series of studies including randomized controlled trials have permitted to better delineate the important pathways allowing a better management of patients with ARDS. Those include the use of protective lung ventilation with limited tidal volumes and airway pressure, appropriate use of high levels of positive end-expiratory pressure or PEEP, and indications for neuromuscular blockers and prone positioning. In real life, ARDS is still associated with high mortality rates, is based on a definition mainly useful for clinical research and is often left unrecognized. In addition, the group of patients meeting ARDS criteria represents a quite heterogeneous group of patients. Given the importance of ventilatory management, however, better clues for individual approaches to therapy are hardly needed. This requires the introduction of monitoring tools in the clinical setting. The esophageal pressure can help to assess the importance of the chest wall in interpreting airway pressures and even for titrating the right pressure level, including PEEP. The measurement of end-expiratory lung volume can help to better assess the size of the ventilated lung and the strain of the lung, and assess recruitability. Potentially, ventilatory settings could be adjusted to minimize the strain below a safe threshold. The amount of recruitable lung may also be potentially evaluated by lung ultrasound and by physiological response to PEEP. Compliance is decreased proportionally to the decrease in lung volume but is also dependent on the initial size of the lung. However, the simple monitoring of the driving pressure, in passive patients, may be a helpful and easily accessible tool to guide therapy, since it represents the tidal volume to compliance ratio, and is very strongly associated to prognosis. Last, monitoring respiratory muscle activity may be essential, both to understand the needs for sedation and paralysis but also for avoiding excessive transpulmonary pressure swings at the time of transition from controlled to partial ventilation. Personalized mechanical ventilation based on better monitoring indicators needs to be defined and should be the basis of future management of ARDS.
COGNITIVE DISORDERS AND ARDS - A (UNDERESTIMATED) COINCIDENCE?

Thomas Bein
University Hospital Regensburg, Germany

Acute respiratory distress syndrome (ARDS) is a potential life-threatening disease caused by direct (chest trauma, contusion, pneumonia, aspiration) or indirect disorders (massive transfusion, sepsis, pancreatitis). Despite scientific and therapeutic efforts ARDS-associated mortality is still high. The main cause of mortality in ARDS is multiple organ failure (MOF), and the crosstalk between the lung and other organ systems is of increasing interest in experimental and clinical investigations. In recent years the brain as a cross-talking organ to the lung has come into focus: the role of the injured brain as a source of inflammation resulting in pulmonary infiltration of neutrophils, cytokine release and endothelial dysfunction has been demonstrated (1). Cognitive disorders are common in intensive care patients and it is discussed that there is a complex crosstalk between the brain and distal organs. In acute traumatic or non-traumatic cerebral lesions brain microglia and astroglia are main sources of inflammatory mediators which pass the disturbed brain-blood-barrier inducing a transcranial increase in distal organs like the lung. In an experimental acute brain injury model the increase in neurotransmitter S100B induced the release of pro-inflammatory cytokines in alveolar-type-I-cells.

In various studies, a higher incidence of acute lung injury or ARDS was found following acute brain injury, sepsis-related encephalopathy, acute subarachnoid bleeding or delirium compared to no disorders of the brain. On the other hand, ventilated patients with ARDS had a higher incidence of delirium compared to mechanically ventilated patients without ARDS. Brain-lung interactions received little attention in the literature so far, and it is hypothesised that pathophysiological pathways between the injured brain and the lung (and vice versa) is of great importance in the promotion of multiple organ failure.

GENETICS AND GENOMICS OF ARDS

Joe GN Garcia  
*University of Arizona, United States*

Acute Respiratory Distress Syndrome ARDS, a common complication of sepsis and trauma, is associated with mortality rates over 30% and with significant health care disparities in specific racial and ethnic populations. As genetic variants likely contribute to ARDS susceptibility and pathobiology, in this lecture we present approaches, enabled by the completion of the Human Genome Project, to rapidly ascertain a patient’s genetic and molecular profile in order to investigate potential genetic susceptibility factors in ARDS. We highlight the utility of utilizing high throughput profiling in multi-species preclinical models of ARDS and ventilator-induced lung injury (VILI) that is combined with advanced bioinformatic techniques to broaden our capture of ARDS-related genes. Extending our system biology approach, we have queried the contribution of single nucleotide polymorphisms (SNPs) in genes involved in ARDS-relevant processes including regulation of vascular permeability and inflammation to the development of ARDS and to ARDS severity including mortality (MYLK, NAMPT, S1PR1, GADD45a). For example, NAMPT is a novel ARDS/VILI susceptibility candidate gene we identified by genomics approaches to be induced by mechanical stress and by mechanical ventilation. NAMPT harbors promoter SNPs that significantly influence gene expression and ARDS susceptibility and severity. The circulation product of this expression is a TLR4 ligand and potent inflammatory stimulus and novel biomarker in sepsis and sepsis-induced ALI. In addition to our genomic studies, we have successfully conducted two high-density genome-wide association studies in non-Hispanic Caucasians and African descent cases with ARDS to fuel interrogation of new ARDS candidates. Together, our genomic and genetic studies have increased our understanding of ARDS mechanisms with dysregulation of key biologic processes (cytoskeletal pathway, NFκB signaling, coagulation, T lymphocyte signaling) and have identified novel targets for highly individualized therapeutic strategies in the critically ill. As ARDS represents the ultimate in genetic stress and there is ample evidence that SNPs in ARDS candidate genes contribute to the development and outcome in ARDS, opportunities exist to leverage these data for risk stratification and identification of subjects at high-risk for poor outcomes who are most likely to benefit from new therapeutic interventions.
INFLAMMASOMES: NEW INSIGHTS IN ARDS

Augustine Choi
Weill Cornell Medical College, United States

Sepsis remains the leading cause of death and cause of adult respiratory distress syndrome in the medical intensive care units. Although inflammatory responses observed in sepsis are important for host defense against invading microbes, excessive inflammation associated with this condition can cause severe cell and tissue damage and organ dysfunction, leading to death. In this presentation, we will focus on the regulation and function of inflammasomes in sepsis and acute lung injury. Inflammasomes are molecular platforms which activate caspase-1-dependent maturation and secretion of pro-inflammatory cytokines such as interleukin (IL)-1β and IL-18 in immune cells. Emerging evidence suggests the involvement of inflammasomes in the pathogenesis of human diseases. Cytoplasmic receptors of the nucleotide-binding domain leucine-rich repeat containing (NLR) family are key components of the inflammasome and interact with apoptosis-associated adaptor protein (ASC), which recruits the precursor form of caspase-1. The NLRP3 inflammasome is unique in its ability to recognize molecular patterns associated with host-derived metabolites such as glucose or saturated fatty acids. Recent studies from this laboratory and others demonstrate that mitochondrial dysfunction involving increased reactive oxygen species (ROS) production and the release of mitochondrial DNA (mtDNA) into the cytosol are critical events involved in NLRP3 inflammasome activation. Furthermore, we have shown that the plasma levels of inflammasome cytokines (e.g., IL-18) and circulating mitochondrial injury markers (i.e., mtDNA) increase in critical illness, and are predictive of mortality.

We have recently observed that inflammasomes are regulated by metabolic dysfunction, in particular both the lipid and glycolytic pathways:

Lipid pathway: Mitochondrial uncoupling proteins (UCP) belong to a superfamily of mitochondrial anion carrier proteins. UCPs uncouple oxidative phosphorylation from ATP synthesis with energy dissipated as heat, a process referred to as the mitochondrial proton leak. Of these, UCP1 was originally identified as a protein responsible for thermogenesis in brown adipose tissue; whereas UCP2, its cellular homologue with weak uncoupling activity, occurs predominantly in cells of the innate immune system. Although the physiological function of UCP2 remains incompletely understood, a role for UCP2 in regulating cellular energy homeostasis and glucose metabolism has been demonstrated in various cell types. We will discuss the regulation and function of UCP2 regulated lipid synthesis in the activation of inflammasomes.

Glycolytic pathway: Here, we demonstrate that the NLRP3 inflammasome regulates hexokinase-1 (HK1)-dependent glycolysis and positive feedback regulation between the NLRP3 inflammasome and glycolysis in activated macrophages. Deficiency of NLRP3 and ASC displayed reduced glucose utilization and glycolytic phenotype in vivo and in vitro. Among glycolytic enzymes, HK1 was specifically increased by NLRP3 inflammasome-activating stimuli. Genetic and pharmacologic inhibition of HK1-dependent glycolysis suppresses NLRP3 inflammasome mediated caspase-1 activation. Our data suggest that the NLRP3 inflammasome regulates HK1-dependent glycolysis during inflammatory responses.
PRONE POSITIONING IN ARDS

Luciano Gattinoni

University of Milan, Italy

Prone positioning, first proposed in 1974 and first applied in ARDS patients in 1976, results in improved arterial oxygenation in most patients. The initial hypothesis was that better perfusion of the baby lung, located in the dependent lung regions after prone positioning, would provide advantages in gas exchange. The picture observed was quite different, however. We did observe an improvement in arterial oxygenation, but the mechanism was likely different because CT scans taken in the prone position showed a density redistribution toward the dependent lung areas.

This observation led to our introduction of the sponge model as our pathophysiologic understanding of ARDS. Whatever the position of the patient, the increased weight of the nondependent lung tissue squeezes the gas out of the dependent regions of the lung. The mechanisms of improved gas exchange were different from that first hypothesized. Taken together, all of the studies, including small and large series of patients, consistently showed that in 70% of the patients systemic oxygenation improves in prone compared with supine positioning, without any change in the applied airway pressure. There is no doubt that in life-threatening severe hypoxemia a trial in the prone position is indicated.

A different issue is the effectiveness of the prone position in improving ARDS outcome. In experimental settings and in normal subjects and patients affected by ARDS, CT scan shows a more homogeneous distribution of gas throughout the lung parenchyma in the prone compared with the supine position. This observation strongly suggests that the distribution of alveolar stress and strain is more homogeneous in the prone position. In experimental models of ARDS, there is evidence that prone positioning prevents or significantly delays the development of VILI. Two large randomized studies on prone positioning were unable to show a significant benefit on outcome; however, prone positioning was applied for only about a quarter of the day, and mechanical ventilation was not controlled. In a more recent trial, in which prone positioning was applied for 20 hours per day and mechanical ventilation was strictly controlled, a positive benefit was found. On these basis the Prone-Supine II study was organized avoiding the limitations of previous trials. Although, the study was not able to show a significant survival benefit in the general population, a favorable trend was detected in severe ARDS. In a meta-analysis including 10 clinical trials on adults and children Sud et al. found that prone ventilation reduced mortality in severely hypoxemic patients (PaO2/FiO2≤100 mmHg, p = 0.01) but not in patients with PaO2/FiO2>100mmHg(p = 0.36). The authors suggestion was that prone position may provide benefits in severely hypoxemic but it should not be routinely used in all patients affected by acute hypoxemic respiratory failure. In a pooled analysis of the four largest databases of trials on prone position, the absolute mortality reduction in severe ARDS treated in prone position was approximately 10% (log-rank = 0.03). On the contrary in patients with moderate ARDS prolonged prone position may be useless or possibly harmful.
RECRUITMENT MANEUVER IN ARDS: LOOKING FOR THE HOLY GRAIL

Paolo Pelosi
University of Genoa, Italy

In patients with acute respiratory distress syndrome (ARDS), a protective mechanical ventilation strategy by using low tidal volumes has been associated with reduced mortality. However, such a strategy may result in alveolar collapse, leading to cyclic opening and closing of atelectatic alveoli and distal airways. For this reason recruitment maneuvers have been used to open up collapsed lungs, while adequate positive end-expiratory pressure (PEEP) levels may counteract alveolar derecruitment and thus minimizing ventilator-associated lung injury. In the present lecture, the current evidence on RMs will be discussed. We suggest to use recruitment maneuver in more severe ARDS in the following cases: 1) before setting PEEP; 2) after ventilator circuit disconnection or 3) as a rescue maneuver to overcome severe hypoxemia; however, their routine use does not seem to be justified at present. More recently there is evidence that slow recruitment maneuver have minor impact on development of ventilator induced lung injury in ARDS. Randomized clinical trials analyzing the impact of RMs on morbidity and mortality in ARDS patients, are warranted.
ARE NEUROMUSCULAR BLOCKERS HELPFUL IN ARDS?

William Hurford

_University of Cincinnati, United States_

The use of neuromuscular blocking agents (NMBAs) in mechanically ventilated critically ill patients remains relatively common. Potential advantages of NMBAs include prevention of patient-ventilator dyssynchrony, including autotriggering, and facilitation and maintenance of lung recruitment and reduction of dynamic hyperinflation reduction. Associated benefits include improved PaO2, prevention of respiratory movements, increased chest wall compliance, and reduced inflammatory mediator release. In a multicenter, double-blind trial of 340 patients presenting to the ICU with an onset of ARDS within the previous 48 hours, patients randomized to receive cisatricurium for 48 hours had an improved adjusted 90-day survival and increased time off the ventilator without increasing the muscle weakness (Papazian L et al. N Engl J Med 2010; 363:1107-1116).

Some disadvantages of NMBAs consist of a variable effect on PaO2, increased atelectasis, cephalad displacement of the diaphragm, inability to increase minute ventilation in response to need for increased carbon dioxide removal (e.g., excessive caloric intake), and airway closure. The use of NMBAs in adequately sedated patients does not appear affect oxygen consumption or energy expenditure.

NMBAs should be used with caution because their administration can eliminate the patient’s ability to cough, hinder neurologic and psychological evaluation, and can be catastrophic in the setting of a ventilator disconnection or malfunction. Neuromuscular blockade makes it difficult to detect whether the patient is in pain or awake and may be associated with myopathies and neuropathies, as well as prolonged recover from prolonged paralysis. Although occasionally refuted, the combination of chronic, high dose steroids and prolonged NMBA use may increase the likelihood of developing an acute myopathy, with an incidence as high as 30%. The use of a peripheral nerve stimulator is advisable to measure the level of neuromuscular blockade and gauge further titrations. Administration of NMBAs that is guided by peripheral neuromuscular monitoring is associated with reductions in the total amount of NMBAs administered and quicker recovery of neuromuscular function and spontaneous ventilation. As a general guideline, the use of NMBAs should be limited to those patients with early severe ARDS. Their early use may be associated with a reduction of barotrauma and improved outcome. In general, however, the dose and duration of NMBA should be minimized and guided by peripheral neuromuscular monitoring, and adequate sedation and analgesia must be provided.
Critical illness is common: approximately 13 to 20 million people worldwide require life support in intensive care units annually (1). Overall, ~25% of patients who require prolonged mechanical ventilation in the ICU develop generalized and persistent muscle weakness; ~1 million patients develop the syndrome of ICU-acquired weakness (critical illness neuromyopathy) annually (2-4). Risk factors include sepsis, multiple organ failure, prolonged mechanical ventilation, use of neuromuscular blockade medications, poor glycemic control and hypoalbuminemia (4,5). Immobility also plays an important role in the development of weakness in the ICU. Muscle mass decreases by an estimated 1.5-2% per day of bed rest; the muscles of the lower limbs and torso are most affected. (6,7) In one study, muscle strength decreased by 3-11% for each day of bed rest in the ICU over 2-years of follow-up (8). ICU-acquired weakness often lasts for months to years following hospitalization, and is associated with increased duration of mechanical ventilation (9,10), increased hospital and ICU length of stay (2,3), prolonged physical symptoms and functional disability (11,12), impaired quality of life (11) and increased mortality (13).

Early mobilization interventions have the potential both to prevent, and hasten recovery from ICU-acquired muscle weakness. Indeed, several recent clinical trials demonstrate that early mobilization of carefully-selected critically ill patients is feasible and safe (14-17) and improves several short-term patient outcomes (18-20) including exercise tolerance and physical function (14,15), fewer days of delirium (14), fewer ventilator-dependent days (18) and reduced hospital/ICU length of stay (21). Different aspects of rehabilitation are needed across the continuum of the patient’s illness. Multidisciplinary rehabilitation teams and protocols are desirable. Individualized goal-oriented treatment plans should be developed and monitored for each patient. Consensus recommendations on safety criteria for active mobilization of critically ill adults receiving mechanical ventilation have been published recently (22). Neuromuscular electrical stimulation (NMES) of skeletal muscle (23) is an alternate rehabilitation method that can be delivered even to immobilized, sedated patients and poses minimal cardio-ventilatory demand (24). It can be provided alone, or in combination with other exercise such as cycling (25). NMES can prevent muscle atrophy (26,27), and improve muscle strength (28-31) for critically ill patients. It is not yet clear whether NMES (32) or conventional rehabilitation (16,33) provided during critical illness improves patients’ long-term outcomes.

Implementation of early mobilization in the ICU requires a major paradigm shift (34,35). Provision of physical rehabilitation to critically ill patients is effort-intensive and requires resources, including skilled multidisciplinary personnel, specialized equipment and time, and can be associated with considerable costs. Despite knowledge of its benefits, multiple barriers to implementation exist (36-38) and early mobilization remains underutilized (39,40).

Further work is needed to identify the optimal rehabilitation methods for persons with varying forms of critical illness, identify the best strategies for implementation of rehabilitation protocols, further evaluate safety
and cost effectiveness of early mobilization, evaluate the benefits of early mobilization begun during critical illness and continued across post-ICU healthcare and home venues, and learn the optimal outcome measures during different phases of illness and recovery.

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PRACTICAL ISSUES IN THE IMPLEMENTATION OF AN EARLY MOBILIZATION PROTOCOL

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Studies reported ARDS survivors experienced decrements of quality of life, although the background disease and clinical course varied widely among patients. Prolonged immobilization during mechanical ventilation in the intensive care unit (ICU) is important components of the poor outcomes. Early mobilization is feasible and safe in patients in the ICU, and associated with improved muscle strength, physical function and quality of life as well as the decreases in length of mechanical ventilation and ICU stay.

To implement early mobilization in the ICU, there are several potential barriers. Preventing deep sedation is one of the most important steps to provide early mobilization. The use of protocols to perform light sedation and to assess patient appropriateness for mobilization is recommended. Education and effective leadership are essential to overcome the barriers.
Acute skeletal muscle wasting and muscle weakness is now recognized as a major complication of critical illness. ICU patients may suffer from sepsis and multiple organ dysfunction (MODS) or experience prolonged periods of mechanical ventilation and difficulty weaning and develop acute skeletal muscle wasting and muscle weakness. Similarly, critically ill patients may suffer from acute malnutrition and a catabolic state, metabolic and electrolyte imbalances and may be exposed to prolonged periods of bed rest and immobility or medications which may lead to or contribute to the development of acute muscle weakness. Ultimately, ICU survivors with ICU-acquired muscle weakness (ICUAW) may endure long-term functional limitations and poor health-related quality of life that can last for months to years.

In the ICU setting, muscle weakness may be due to (1) a pre-existing neuromuscular disorder, (e.g., myasthenia gravis), (2) a new-onset neurological disorder (e.g., Guillain-Barre syndrome), or (3) a complication of critical illness (e.g., ICUAW). Thus, ICUAW refers to the acute onset of generalized, symmetric skeletal muscle wasting and weakness in the critically ill for which there is no etiology other than the critical illness.

The etiology of ICUAW may be multifactorial and includes: (1) disuse muscle atrophy from prolonged bed rest and immobility, (2) critical illness polyneuropathy (CIP), (3) critical illness myopathy (CIM), or (4) a combination of both, critical illness polyneuromyopathy (CIPNM).

ICUAW is common with a reported median incidence of 47% (range 9-86%). Important factors associated with ICUAW include severe sepsis, and prolonged mechanical ventilation. Other reported factors include multiple organ failure, muscle inactivity, hyperglycemia and hyperosmolality, parenteral nutrition, and the use of medications such as corticosteroids, and neuromuscular blocking agents (NMBAs).

Severity of illness, the presence of the systemic inflammatory response syndrome (SIRS), and prolonged organ failure have been associated with loss of muscle mass, muscle weakness and electrophysiological neuromuscular abnormalities. Clinically significant ICUAW occurs in 25 to 65% of patients requiring mechanical ventilation for more than 5 days and has been associated with increased duration of mechanical ventilation, difficulty weaning, and longer ICU and hospital stays. Similarly, controlled mechanical ventilation (CMV) alters diaphragmatic structure and contractile function resulting in rapid-onset diaphragmatic atrophy and weakness, leading to delays in weaning from mechanical ventilation. Prolonged bed rest and complete or nearly complete immobility is common in ICU patients. Prolonged bed rest leads to enhanced proteolysis and decreased protein synthesis, and a net loss in muscle mass and muscle strength.

Hyperglycemia in the ICU has been reported as an important risk factor for ICUAW. Two large randomized controlled trials of intensive insulin therapy (IIT) showed a strong association between electrophysiological CIP and hyperglycemia. In these trials, IIT significantly protected against CIP. The protective effect seems related to maintenance of blood glucose levels rather than to the insulin dose. Associations between the use of NMBAs and/or corticosteroids with ICUAW have been inconsistent. Earlier reports noted an association between exposure to either NMBAs or corticosteroids and ICUAW. However, these studies failed to adjust for other confounders.
COPING WITH THE HEMODYNAMIC EFFECTS OF PEEP

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EXTRA-VASCULAR LUNG WATER AND VOLUME RESPONSIVENESS

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The decision to administer fluids in critically ill patients must be based on the presence of the three following conditions: 1) hemodynamic instability or peripheral hypoperfusion, 2) preload responsiveness, and 3) limited risks of fluid overload. The first condition is well assessed by the presence of one or more of the following signs: mottling, increased capillary refill time, hypotension, oliguria, hyperlactatemia, etc. The second condition is better assessed by dynamic markers of preload responsiveness than by static markers of preload such as CVP or left ventricular end-diastolic volume [1]. In patients mechanically ventilated with normal tidal volume, well adapted to their ventilator and with sinus rhythm, the best dynamic markers of preload responsiveness are: arterial pulse pressure variation, stroke volume variation and respiratory changes in the inferior vena cava diameter (assessed by ultrasounds) [2]. In patients with arrhythmias, or with spontaneous breathing activity or ventilated with low tidal volume or with low lung compliance, the respiratory variability indices are less valuable and it is recommended to perform a passive leg raising test and follow the changes in cardiac output using any real-time cardiac output monitor [1, 2]. The end-expiration test could also be a good alternative in mechanically ventilated patients [1]. The third condition is at best assessed by the measurement of extravascular lung water (EVLW) using a transpulmonary thermodilution device. This variable provides a quantitative measure of pulmonary edema and has a prognostic value in patients with ARDS [3]. Given that only half of the critically ill patients with hemodynamic instability are fluid responders [4], and that fluid overload is an independent risk of mortality [5], it is mandatory to assess the benefits/risks ratio before any fluid administration in patients with hemodynamic instability, at least in those with ARDS. The numerator (benefits) can be assessed by preload responsiveness variables or tests and the denominator (risks) by EVLW. Advanced hemodynamic monitoring techniques such as transpulmonary thermodilution devices are suitable for assessing the benefits/risks ratio in patients with shock and ARDS [1] since they not only provide EVLW measurements using the thermodilution technique but also dynamic tests such as pulse pressure variation or stroke volume variation or the real-time cardiac output response to passive leg raising using the pulse contour analysis technique.

References

THE VALUE AND LIMITS OF CENTRAL AND MIXED VENOUS OXYGEN SATURATION

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Mixed venous oxygen saturation (SvO2) represents systemic oxygen supply/demand adequacy and has been studied during shock, sepsis, and other clinical conditions. Since SvO2 depends on systemic O2 delivery and tissue O2 extraction capacity, this value is considered an indirect measurement of tissue oxygenation. However, obtaining SvO2 requires invasive monitoring techniques and thus, the superior cava vein O2 saturation (ScvO2) has been proposed as an easier surrogate or equivalent measure. It has been recognized that both low SvO2 or ScvO2 values, could be associated with low cardiac output states. Even when ScvO2 can not reflect metabolic changes coming from the lower part of the body (inferior cava vein oxygen saturation), neither from myocardial metabolism (coronary sinus oxygen saturation), this value has been recommended to guide therapy during resuscitation of septic shock and postoperative patients. At the same time, the controversy still persists regarding whether ScvO2 and SvO2 are equivalent measurements. In fact, several investigations have demonstrated that both variables are not interchangeably. Moreover, the physiological significance of the delta saturation between both variables has been investigated, and a positive ScvO2-SvO2 gradient was found to be associated with improved survival in critically ill patients.

More recently, new multicenter clinical trials have questioned the relevance of including the central venous O2 saturation to guide resuscitation during septic shock states. Septic patients may have decreased O2 extraction capacity secondary to microvascular dysfunction and/or mitochondrial damage. These conditions may affect venous O2 saturation leading to increased both SvO2 and ScvO2 values. Thus, normal or increased venous saturation cannot rule out tissue dysoxia. In fact, increased values have also been found to be associated with decreased survival in critically ill patients. Furthermore, the study of the association between venous saturation and arterial lactate concentration has been shown to be useful to identify patients at risk.

Finally, there is some experimental data showing that microvascular alterations, as decreased perfused microvascular density or increased heterogeneity of perfusion, are associated with increased or decreased mixed venous O2 saturation during septic shock. Both conditions were observed to course with increased arterial lactate concentration. These findings reinforce the concept that microcirculatory dysfunction may explain venous O2 saturation changes, and is on the basis of tissue oxygenation disorders. The complex relationship between these variables needs to be further investigated.

Conclusions. The measurement of central or mixed venous oxygen saturation could be clinically useful to guide hemodynamic resuscitation but should be analyzed with caution. The combination of these measurements with other relevant clinical signs or metabolic parameters should be useful to better characterize tissue oxygenation.
FUNCTIONAL HEMODYNAMIC MONITORING

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Hemodynamic monitoring is thought to be useful in guiding resuscitation therapies, though static hemodynamic variables, like CVP, Ppao or LV end-diastolic volume do not define volume responsiveness (1). However, if Pra increases rapidly (>2 mmHg) during fluid resuscitation, fluid infusion should be stopped and RV function reassessed (3).

Dynamic hemodynamic measures show better utility, and their interpretation reflect functional hemodynamic monitoring (4). During positive pressure breathing, measures of left ventricular outflow variation quantified by either arterial pulse pressure (PPV) or stroke volume variation (SVV) vary in proportion to the host’s volume responsiveness (1, 4, 6). The greater the degree of PPV or SVV the more cardiac output will increase to volume challenge (1). Similarly, the increase in arterial pulse pressure during transient end-expiratory pauses from positive pressure ventilation also predict volume responsiveness (8). In spontaneously breathing subjects or those with arrhythmias, one must use either the dynamic change in cardiac output in response to a passive leg raising maneuver or the effect of a small bolus fluid infusion (9).

The ratio of PPV to SVV defined the lumped dynamic arterial input elastance (Ea) and has a normal range of 1 to 2. If Ea is < 0.8 then pathological vasodilation is present. Thus, in a hypotensive patient, if PPV/SVV is < 0.8 even if volume resuscitation increases cardiac output, blood pressure may not increase sufficiently to restore pressure-dependent organ blood flow and the combined use of vasopressors plus fluid resuscitation would be used (10).

References

THE ROLE OF ECHO IN EVALUATING HEMODYNAMIC STATUS IN THE CRITICALLY ILL

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Echocardiography is an excellent tool to use in the haemodynamically unstable patient. Well known for its role in cardiac diagnosis, it has moved onto centre stage in the hemodynamic evaluation of the critically ill patient. It can also be used for monitoring purposes and occasionally as an assist in a therapeutic procedure.

A number of pathologies may cause hemodynamic instability. There may even be a multitude of pathologies present in a single patient. Although other techniques can measure cardiac output, systemic and pulmonary pressures and give a guide to static measurements on intravascular volume, they do not uncover the actual underlying cardiac pathology. Echocardiography can readily identify many of these pathologies, including left ventricular contraction failure, left ventricular diastolic dysfunction, valvular disease, right heart dysfunction, pulmonary hypertension, pericardial disease in addition to intravascular volume disturbances.

Assessment of volume preload by echo can be undertaken by a number of different techniques including diameter measurements of the inferior and superior vena cavae, stroke volume/cardiac output/velocity time integral changes to straight leg raising/ volume challenges, mitral inflow velocities and tissue Doppler imaging measurements of the mitral annulus. Cardiac contractility is often subjectively evaluated in the acute setting but can be objectively measured and monitored using cardiac output, left ventricular ejection fraction or specific Doppler indices. In the past there has been a tendency to ignore left ventricular diastolic dysfunction, not because it is not commonly encountered, but rather because of the challenge in accurately assessing it. Improved techniques now make it easier to include this in a regular cardiac assessment in the critically ill patient. Increasingly other previous ignored pathologies are recognized such as dynamic left ventricular outflow obstruction, a condition often made worse by treatment with inotropes.

The emphasis on monitoring suggests that echocardiography is not suitable as it requires a skilled operator and is seen as a single time study. This is a valid argument but can be viewed from a different perspective. When echo is combined with a less invasive modality such as pulse contour analysis, it is possible to avoid more invasive techniques such as PAC or PiCCO. Also many patients, although requiring monitoring, do not require minute to minute monitoring but once to twice daily assessments, this easily being undertaken by echo.

In summary the clinician should use the hemodynamic monitoring techniques he/she has experience with. The technique causing the least harm to the patient is preferred. Over the past decade the evolution of echocardiography in the critical care setting offers the clinician a noninvasive hemodynamic assessment tool, which also offers excellent diagnostic capability, allowing for a more carefully structured management plan to be executed.
HEMODYNAMIC MONITORING ‘BACK TO THE BASICS!’

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The main goals of hemodynamic monitoring are to confirm and maintain hemodynamic stability, and diagnostic and guide the treatment of hemodynamic instability in order to restore hemodynamic stability. Although clinical trials and various guidelines use numeric targets for hemodynamics, such targets can never replace common sense at the bed side. Hemodynamic stability can to great extent be based on clinical judgement and careful clinical assessment of the patient. A patient with normal mental state, without obvious, clinically relevant hypotension, normal capillary perfusion and refill in the periphery and warm skin temperature, normal central and peripheral venous filling, with ongoing diuresis, and without hyperlactatemia is very unlikely to have any relevant hemodynamic instability. Conversely, a patient who is clearly ill and do not fill one or several of the aforementioned clinical criteria for stability should be suspected to have hemodynamic instability. This should prompt a careful search for a possible cause of instability and prompt treatment. Low and symptomatic blood pressure or a symptomatic acute decrease in blood pressure, suspicion of cerebral or coronary hypoperfusion, acute reduction in urinary output relate to blood pressure decrease, peripheral vasoconstriction and/or decreased venous filling, oliguria, and elevated blood lactate are all signs of possibly inadequate hemodynamics. In an unstable patient, empty veins signal for hypovolemia, and hypovolemia should be treated without delay. If the patient does not respond as expected, more diagnostics and monitoring (and treatment modification) is necessary. This should start by repeated clinical assessment and, if this does not explain the lack of response, expanded diagnostics and monitoring. Assessment of blood flow by any of the available methods, and echocardiography, if available, should be the next steps. The more complicated the disorder, the more complex and invasive monitoring may be needed.
DELIRIUM: PREVALENCE, DIAGNOSIS AND PREVENTION

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INTRODUCTION

Delirium is a commonly observed manifestation in critically ill patients, with incidence between 11% and 80% and has significant clinical and financial impact, due to its association with increased morbidity, mortality, prolonged hospital stays, prolonged duration of mechanical ventilation and relationship to long-term neuropsychologic deficits with increased ICU and hospital mortality. This form of acute brain dysfunction affects up to 80% of ICU patients, and it is estimated that is associated with $ 4 billion to $16 billion annually in the United States.

Its Pathophysiology is highly heterogeneous and not completely understood. One of the primary mechanisms involved seems to be an imbalance in neurotransmitter systems, in particular a reduction of the acetylcholine activity. Other involved neurotransmitter disorders are an excess of serotonin and dopamine, which both affect the cholinergic system. Gamma-aminobutyric acid (GABA) the most important inhibitory neurotransmitter in the central nervous system, play an important role in the pathogenesis of delirium.

What is Delirium?

The Diagnostic and Statistical Manual of Mental Disorders IV defines delirium as a disturbance of consciousness with inattention, accompanied by a change in cognition or perceptual disturbance that develops over a short period (hours to days) and fluctuates over time. Delirium can’t manifest with 1 of 2 subtypes and often a mixture of the 2. Hyperactive delirium is present when patients meet the delirium definition criteria and are agitated, restless, attempting to remove catheters or emotionally labile. This has historically been referred to as “ICU psychosis”. Conversely, hypoactive delirium is characterized by a flat affect, withdrawal, apathy, lethargy, and decreased responsiveness, often referred to as “quiet delirium”. Sometimes delirium could be a mix of the 2.

Identifying and modifying the risk

Risk factors for delirium have been under studied and underreported. The principal risk factors are preexisting dementia, history of baseline hypertension, alcoholism, and severity of illness. Age has been identified as one of the most significant risk factors. Sedatives have been the only consistently identified ICU delirium risk factor. Successful risk factor modification strategies for reducing the incidence of delirium are: 1) Early mobilization/physiotherapy, 2) Protocols, guidelines and education of health care providers, 3) Orientation and environmental stimulation eg clocks, calendars, discussions of events, 4) Sleep protocols and proper day/night, 5) Sensory aids provided as needed, 6) Medication review/eliminate unnecessary medications, 7) Proactive geriatric or specialist consultation, 8) Pain management and 9 family presents. A readily available prediction model to identify high-risk patients would facilitate the used of preventive interventions. Recently, the PRE-Deliric prediction model was developed and validated for ICU patients based on identified risk factors for delirium in ICU patients. The prediction model include the relevance of 10 different delirium associated risk factor in daily ICU practice, such as age, APACHE II, urgent and admission category, use of sedatives, morphine use, urea level metabolic acidosis an presence of and infection.
**The wake up and breathe protocol**

The association of deep sedation, as well the strong association of benzodiazepines with delirium directs that sedation-sparing strategies be adapted to decreased delirium and improved patients outcomes. Such strategies include targeted sedation protocols and Wake Up and Breathe Protocol, which pairs spontaneous awakening trials and spontaneous breathing trials.

**Choice of sedation**

Numerous reports identify sedatives and analgesics are responsible for the development of delirium in the ICU. In 2002 the Society of Critical Care Medicine recommended the ICUs benzodiazepines for sedation management in the ICU. Since that time studies have reported benzodiazepines to be an independent risk factor for the development of delirium. Pandharipande et al reported that there was a 100% probability of transitioning to delirium the next day if the patient received 20mg or more of lorazepam in a 24-hour period. Dexmedetomidine, is an α₂-adrenergic receptor agonist that inhibits norepinephrine and epinephrine in the central and peripheral nervous system. This results in sedation and analgesia without respiratory depression, patients being easily roused, anxiolysis and decreased sympathetic activity. There are 2 studies that confirm this: MENSDS and SEDCOM.

**Delirium detection**

Over the past 10 years several tools have appeared in the literature for the assessment of delirium in the ICU: a) Cognitive test for delirium, b) Confusion assessment method for the intensive care unit, c) Delirium detection score, d) Intensive care delirium screening checklist, e) Nursing delirium screening scale. The 2 commonly used instruments with robust validity are the Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC).

**Pharmacologic management**

No drug has been approved by the FDA to treat delirium. A recent survey reports that more than 80% of critical care practitioners treat delirium with the antipsychotic haloperidol. Known that delirium is largely a disorder of neurotransmitter imbalance involving multiple different neurotransmitters, antipsychotics (ie, haloperidol and atypicals) have been postulated as drugs that may help correct the imbalances.

**Bibliography**

Pain anxiety and delirium are still very frequent in ICUs. Recent literature report that 77% of patients in a cardiac surgery unit experience pain. And in another study, 50% of mechanically ventilated patients recalled experiencing moderate to extreme pain, anxiety, fear, and inability to sleep during their ICU stay. Providing effective analgesia and sedation is a universally accepted goal for critically ill patients, because of the pain and discomfort associated with mechanical ventilation and invasive bedside procedures, which worsens the pain and discomfort caused by the primary disease, surgery or trauma.

Traditionally a sedative, hypnotic approach has been employed to manage patient discomfort, where benzodiazepines and propofol are commonly used. It has been shown that with this approach, many patients experience inappropriate levels of sedation (either undersedation or oversedation) with a tendency for oversedation in 40 to 60% of patients. Moreover adverse consequences of sedative agents, like increased duration of mechanical ventilation, increased length of ICU stay, and development of ICU delirium has prompted health care providers to reevaluate sedation practices to search for regimens that are not only effective, but also minimize risks for negative short and long term outcomes.

Analgosedation, also referred to as analgesia-based sedation is one emerging strategy for analgesia and sedation in adult ICU patients. When using analgosedation strategies, opioid medications are titrated to achieve not only pain control but a goal level of sedation. If the goal level of sedation is not achieved after optimization of pain control, traditional sedative and hypnotic agents like benzodiazepines and propofol may be utilized. Several clinical trials have demonstrated analgosedation produces the desired level of sedation at a similar frequency compared with traditional sedation regimens.

Analgosedation has been associated with decreased mechanical ventilation time, decreased ICU length of stay and reduced utilization of sedative drugs. Other potential benefits to patients by reducing sedative use may include decreased risk of delirium and sleep cycle abnormalities.

The most studied opioid analgesic in analgosedation regimens is remifentanil. The pharmacokinetic profile of remifentanil includes: rapid onset, short duration and organ independent metabolism, which prevents accumulation after prolonged infusions. Fentanyl has also been studied using an analgosedation strategy with similar results.

Disadvantages of analgosedation must also be considered. Development of ICU delirium has been associated with use of opioids. Opiate adverse effect profiles can be significant and will vary depending the opioid utilized as will propensity for drug accumulation. Analgosedation is associated with a recall of unpleasant events, nightmares and hallucinations.

Based on emerging data, it may be reasonable to incorporate analgosedation strategies into the care of our ICU patients.
IMPLEMENTING CHANGE FOR ICU PATIENTS: THE PAD GUIDELINE

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It is imperative as healthcare professional that we increasingly focus on the public health problem of acute and long-term brain dysfunction amongst critically ill patients during and following their illness. Delirium is an extremely common organ dysfunction and a strong independent predictor of length of stay, cost of care, death, and long-term cognitive impairment that resembles an acquired dementia of the severity of Alzheimers disease or traumatic brain injury. Numerous modifiable causes have been identified (including delirium duration) and workers all over the world are attempting to reduce the onset and duration of delirium and both prevent and manage the long-term acquired dementialike illness that ICU survivors suffer from so severely. It is high time that medical interventions designed to improve neurological recovery are subjected to appropriately designed and robustly powered randomized controlled trials.
HALF OF WHAT WE DO IS WRONG, WE JUST DON’T KNOW WHICH HALF

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Err is human. Iatrogenesis (from the Greek for "brought forth by the healer") refers to any effect on a person, resulting from any activity of one or more persons acting as healthcare professionals or promoting products or services as beneficial to health, that does not support a goal of the person affected. In another word all Professionals having relation to ICU care may cause harm to patients include physicians, pharmacists, nurses, dentists, psychologists, and therapists. Iatrogenesis can also result from complementary and alternative medicine treatments.

Iatrogenic complications in the ICU are inevitable and often lead to medical emergencies. They may affect the clinical course of patients by increasing morbidity and mortality. Strategies for the implementation of a bundle of evidence-based strategies for reducing mortality due to ICU-acquired techniques or procedures. Early mobility, invasive procedures, anemia and malnutrition should be address. Inadequate technology implementation is not an excuse to accept iatrogenity and malpractice.

Some iatrogenic effects are clearly defined and easily recognized, and can be avoided through application of a proper guidelines and protocols to be follow and quality control is applied, accordingly complication of insertion of a central line should be almost zero. Less obvious ones, such as complex drug interactions, may require significant investigation to identify, While some have advocated using “iatrogenesis” to refer to all “events caused by the health care delivery team”, whether “positive or negative”, consensus limits use of “iatrogenesis” to adverse, or, most broadly, to unintended outcomes.

Causes of iatrogenesis include: side effects of possible drug interactions, medical error, negligence, unexamined instrument design, anxiety or annoyance in the physician or treatment provider in relation to medical procedures or treatments and unnecessary treatment for profit.

Examples of iatrogenesis and human errors:
1. Risk associated with medical interventions Adverse effects of prescription drugs
2. Over-use of drugs, (causing - for example - antibiotic resistance in bacteria)
3. Prescription drug interaction
4. Medical error
5. Wrong prescription, perhaps due to illegible handwriting, typos on computer.
6. Negligence
7. Nosocomial infections
8. Faulty procedures, techniques, information, methods, or equipment

Unlike an adverse event, an iatrogenic effect is not always harmful, and does not represent improper care and may not be troublesome.
CRITICAL ILLNESS IS AN IATROGENIC DISEASE

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Critical illness is an inherently iatrogenic state. It only arises in patients who, in the absence of medical intervention, would have succumbed to an otherwise lethal insult. In the past, and the response to infection or injury was either death or a relatively rapid recovery. The emergence of ICU technologies over the past half century added a further layer of possibility to the process of resuscitation, by sustaining life during a time of otherwise lethal vital organ insufficiency. But ICU technologies also challenged fundamental concepts regarding clinical biology and spawned an unprecedented group of new disorders that are the direct consequence of resuscitation and treatment.

Positive pressure ventilation delivers oxygen into the blood, but at the cost of injury to the alveolar membrane which in turn evokes a local inflammatory response and subsequent repair; in aggregate, the process is recognized as ARDS. Systemic antibiotics kill both the pathogen and elements of the host microbiota, and so alter the complex homeostatic relationships that exist between the host and the endogenous microflora, alterations that result in enhanced susceptibility to nosocomial infection, and other, less well-characterized sequelae. Transfusion restores oxygen carrying capacity, but at the cost of a low grade immune response to transfusion antigens. Fluids sustain intravascular volume, but at the cost of interstitial edema and impaired oxygen delivery at the cellular level. Sedation and bed rest result in muscle atrophy and prolonged ICU dependence. It is striking that the most effective interventions in the ICU are not novel therapies that target underlying host biology, but approaches that limit the adverse consequences of ICU support.

At a fundamental level, the most important thing that the intensivist can do is to liberate the patient from the need for ICU support, and to do so as rapidly as possible, and failing that, to minimize unnecessary interventions and minimize the adverse effects of those that are necessary to sustain life.
PATIENT SAFETY IN THE ICU: KEY CONCEPTS

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The ICU setting can be a stressful environment and perceived by family members as an extraordinary place. Frequently reported stressful environmental factors are noise, ambient light, restriction of mobility, and social isolation (Wenham and Pittard, 2009). The desire of the family for involvement during this critical event is expected. However, family involvement is often limited by the hospital policies on visitation. Likewise, the busy clinicians, despite their intention to support the family have inconsistently provided for the needs of the family.

Many studies have shown that addressing the need of the family during critical illness of a patient is a universal problem. The family experience in ICU can eventually be dissatisfying or burdensome for the family member. Learning from the family experience can lead to better understanding of the expectations of the family and the identification of their risk profile will provide the clinicians with better perspective on assisting the needs of the family members.

In the Philippines hospital follows the restricted or limited visiting time and access policy. Specific time in a day is designated for family visits and likewise the visitors are limited to at least two members at a time. Age discrimination is also common, limiting visitation to those over the age of 7 years. This view on visitation is influenced by the earlier practice and perspective of western and modern medicine. This policy on visitation is opposing the cultural concepts of the Filipino. Despite the restrictive policy, flexibility is often practiced by nurses who served as the controller of environmental traffic in the respective area. They have influence over the hospital security and can negotiate for the family presence after visiting time is over.

Family presence is an expectation in most hospital in the Philippines during this critical period of hospitalization. Filipino family members served as watchers and are expected to play a vital role in the care of the patient. The concept of having family member watch over a patient is a cultural dynamic that portrays how closely knitted family members are in the Philippines. During the time of illness the patient would prefer their family to provide the basic care rather than receive it from the nurse. Most often the family member would assist their patient with hygiene needs or basic needs like feeding, provision for comfort, and other activities of daily living.

This presentation will provide information of the Filipino family satisfaction based on their experience of the ICU care. It will take into considering the different culture and scenario that the ICU environment presents thereby providing some concepts that will be uniquely Filipino and support concepts known universally as factors influencing family satisfaction in ICU care.
ARRHYTHMIAS, DIAGNOSIS, AND MANAGEMENT IN ICU

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**MUSCLE WASTING AND WEAKNESS IN CRITICAL ILLNESS**

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The development of skeletal muscle wasting and weakness is common in patients with critical illness. The development of muscular weakness predisposes to complications such as hypostatic pneumonias, pressure area necrosis and deep vein thrombosis, and thus impacts on mortality. Survivors from ARDS reported limitation in activities of daily living at 5 years caused principally by musculoskeletal problems rather than respiratory dysfunction. Muscular weakness may be caused by nutritional depletion, inflammatory responses, the effects of drugs (steroids, neuromuscular blocking agents), the effect of disuse and immobilisation and the development of polyneuropathies and myopathies. Critical illness polyneuromyopathies can be considered as another organ failure in the multiple organ failure syndrome. Although there are no proven treatments for muscle wasting and weakness in critical illness, it is important to identify the problem such that ventilator weaning and rehabilitation strategies can be appropriately tailored to the patient.

The relationship between nutrition and muscle degradation in critical illness in man is unproven. In sepsis, increased protein breakdown may be a more important mechanism of muscle wasting than reduced synthesis. Although glutamine has been promoted as a skeletal muscle anabolic nutrient in illness, studies to date have failed to convincingly confirm this hypothesis.

Immobilisation, which is common in critical illness, is a potent cause of muscle atrophy. Passive stretching of muscle in critically ill patients receiving neuromuscular junction blocking agents resulted in preservation of muscle architecture, reduced protein loss and less fibre atrophy. Immobilisation is likely to be a contributor to critical illness-associated muscle wasting but not to be the entire explanation. Nonetheless, rehabilitation physiotherapy should be commenced as early as possible for critically ill patients.

Critical illness-associated neuropathies and myopathies were initially described in patients receiving mechanical ventilation for severe asthma. These findings were attributed to use of steroids in high doses and the prolonged infusion of non-depolarising neuromuscular blocking agents. Whilst myopathy in association with steroid use is well recognised, myopathy and neuropathy occur commonly in critically ill patients that have never received steroids or neuromuscular blocking agents. The natural history of neuromyopathies is slow recovery, however, the resultant weakness may significantly compromise, and prolong, rehabilitation.

Management is essentially supportive. Nutritional support should be considered early after intensive care admission and glycaemia should be carefully controlled. Passive stretching of limbs and early recourse to rehabilitation-type physiotherapy may also be beneficial.
PREVENTION OF GASTRO DUODENAL STRESS BLEEDING

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Upper gastrointestinal bleeding related to stress ulcers (UGISB), was formerly a fearsome complication of intensive care, but its incidence has decreased over the years, possibly owing to better care of critically ill patients. The occurrence of UGISB is associated to numerous factors (mucosal ischemia, mucosal damage, acid back diffusion...), and the relevance and efficacy of specific preventive measures is controversial.

A standardized definition of UGISB is necessary to compare the incidence of UGIB in different settings. Most authors consider that only \textit{clinically relevant} UGISB should be taken into account. However, this definition is not sufficient, as not all such cases are confirmed by further investigations. That is why endoscopic confirmation is needed.

UGISB complicates less than 2% of ICU stays and occurs preferentially in severely ill patients.

Many prophylaxis trials have been performed, their methodology has to be discussed in detail because of the heterogeneity of the objectives and of the patients, because of the different methods used to diagnose UGISB. The last meta-analysis have conflicting results except on the fact that prophylaxis does not decrease patients mortality in ICU.

Despite Cooks randomised controlled trial, the precise profile of the patients who need prophylaxis is still not known. In a survey performed in France in April 2015, 56 intensivists answered, 25 working in a teaching hospital (A) and 31 in a general hospital (B). To the question, do you use systematically stress ulcer prophylaxis in patients under mechanical ventilation for more than 48 h, answer was yes for only 12% for A and 38.7% for B (p<0.05).

Systematic prophylaxis against UGISB for patients with severe sepsis is certainly not well justified by the current evidence.

There is no proof to recommend any drug for UGISB prophylaxis in severe sepsis. A causal link between drugs increasing gastric pH and occurrence of nosocomial pneumonia has still to be demonstrated.

Proton pump inhibitors which are actually considered the drug of choice to inhibit the acid production have not been evaluated in trial using endoscopic confirmation. In the French survey PPI were used in 84%.

In any further evaluation trials a control placebo group is absolutely necessary and the number of patients should be sufficient.

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HUMIDIFICATION FOR PATIENTS WITH RESPIRATORY FAILURE

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Through upper airway, warm and humid inspiratory gas reaches the lower airways. On the contrary, the upper airway is bypassed via an artificial airway in mechanically ventilated patient. Cool and dry gas induces bronchoconstriction in the nasal mucosa. Conventional oxygen devices with dry and cold gas associate to mask discomfort, nasal dryness, oral dryness, eye irritation, nasal and eye trauma, gastric distension and aspiration. Adequate heating and humidification improve mucociliary function, facilitate secretion clearance and decrease atelectasis formation resulting in good ventilation-perfusion ratio and oxygenation. Humidifying devices to replace the upper airway functions are essential to heat and humidify gases during mechanical ventilation.

Heated humidifiers

There are several types of heated humidifiers with a water reservoir, such as a pass-over humidifier, a heated bubble humidifier, a vapor phase humidifier, and a wick humidifier. Servo-controlled heated humidifiers work with a heated wire inside an inspiratory ventilator circuit to maintain temperature enroute to the patients. The humidifying efficiency depends on the amount of time that gas is in contact with water. High minute ventilation reduces residence time in the reservoir. ARDS network demonstrated that the lung protective approach with a low tidal volume ventilation improved survival rate of ARDS patients. When tidal volume is low, it takes long for gas to pass through the inspiratory circuit, and increases condensation resulting in poor humidity.

Heat and Moisture Exchanger (HME)

HME is an alterative device to warm and humidify inspired gas. HME is a passively acting humidifier that collects the patients expired heat and moisture and returns it during the following inspiration. The moisture output is dependent on tidal volume, inspiratory time, breathing frequency, temperature, and positioning. Although HME is a simple device and has many advantages over heated humidifiers, the moisture output is limited.

Non-invasive ventilation (NIV)

NIV is often applied without humidifying devices because an intact upper airway is maintained. However, oral dryness is a common problem during NIV, and it may alter the oral flora, leading to an increased risk of aspiration pneumonia. It can be associated with increased mucus viscosity and retained secretion, resulting in an increased risk of difficulty with endotracheal intubation in the case of NIV failure. Although consensus statements and guidelines for NIV contain conflicting recommendations concerning humidification, adequate humidification is essential even during NIV.
High-flow nasal cannula (HFNC)

Usually oxygen is not humidified at low flow, or at most it is humidified with bubble humidifier. HFNC delivers up to 100% heated and humidified oxygen at a maximum of 60 L/min of gas via heated single circuit and nasal cannula with large diameter. It is supposed to have a number of physiological effects, and adequate humidification is considered to play an important role. This alternative to conventional oxygen therapy has received growing attention.

Conclusions

Humidification is essential for all patients with respiratory failure. Inadequate humidification injures the lung seriously. We should have good knowledge of each device to prevent inadequate humidification and to protect the lungs of mechanically ventilated patients from serious damages.
WHO SHOULD SHARE IN SHARED DECISION-MAKING?

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Decision-making potentially resulting in withholding (WH) or withdrawal (WD) of life support at the end of life (EOL) is complex and is generally divided into two steps. Firstly it is necessary to decide that WH/WD is potentially in the patients best interest. Once this decision is made, a discussion with the patient, or more usually the family/surrogate, takes place with the intention to establish that the decision to WH/WD life support is in keeping with the patients values, and thus the patients right to autonomy is satisfied. It can be seen that shared decision-making is potentially relevant to both the first and subsequent decision.

In practice the health care professional team are usually responsible for the first decision, even although initiation of the discussion could be by any stakeholder. The Welpicus study used a Delphi process to obtain an international consensus on key definitions and statements relating to decision-making by a large group of doctors, nurses, social workers and some lawyers 1. Shared decision making was defined as a dynamic process with responsibility for decisions about the medical care of a patient being shared between the health care team and the patient or surrogates 1. Furthermore it was agreed by consensus that ultimately decision-making about end-of-life care should be made by a multidisciplinary team, after discussions with the patient and/or the surrogate decision maker or family after consensus development 1.

It is apparent, however that the parties consulted as part of the multi-disciplinary team vary between cultures and regions, and additionally decision-making is achieved in a truly shared manner with patient/surrogates in some cultures/regions more than in others 2-5. In this context it is difficult to assess which approach constitutes best practice. Methods of establishing the best approach would require assessment of measures of outcome such as patient/surrogate satisfaction with the process, patient suffering, or an unjustifiable prolongation of the dying process. Although the data are sparse, they suggest that different approaches for different cultures/regions may be currently necessary, and that communication techniques such as early goal of care discussions and integrated communication strategies, may be of potential benefit.
THE CONCEPT OF AUTONOMY

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Twenty-five years ago, most major medical decisions were left exclusively in the hands of physicians. They were usually made with beneficent intent but without open discussion, much less the full participation of the patient. This paternalistic approach had some benefits. Physicians struggled to make the best possible decisions on behalf of patients, and they spared patients and their families from agonizing about interventions that had little chance of working. Practitioners also had much more control over the way that medical technology, with its increasing potential to help as well as to harm, was used. In retrospect, physicians now see obvious problems with excessive paternalism: It can be difficult to determine what a patient’s best interests are; inappropriate biases caused by sex, race, and socioeconomic status can affect decision making; and patients can be deprived of the opportunity to make decisions that reflect the reality of their conditions. However, some of the truly beneficent potential of medical paternalism has been lost.

In the United States in the late 20th century, the pendulum has swung away from paternalism and toward patient autonomy. Too often, “autonomous” patients and families are asked to make critical medical decisions on the basis of neutrally presented statistics, as free as possible from the contaminating influences of physicians. The causes of this trend are multifactorial. The consumer movement has taught patients to be more assertive, to question physicians’ recommendations, and to demand interventions that might otherwise be withheld. Many physicians feel that giving patients the full range of choices and withholding their own recommendations are safeguards against lawsuits. The probabilistic nature of medical decision making in real life is in unnerving contrast to the grand successes and simplistic solutions suggested in the mass media. The information explosion within the field of medicine has left physicians and their patients uncertain about whether the limitations they encounter are inherent in medicine or are a reflection of deficits in the physician’s expertise. Furthermore, when a bad outcome results from a good clinical decision, the chagrin that a physician feels is more emotionally painful—and the risk for being sued is higher—if that decision was recommended to the patient. Many physicians have come to believe that the safest course is to withhold their recommendations and give patients the “choice” of any treatment they might “want.”

The physician-patient dialogue that characterizes the enhanced autonomy model includes active listening, honest sharing of perspectives, suspension of judgment, and genuine concern about the patient’s best interests. In contrast, discussions typical of the independent choice model are often restricted by concern over the potential for domination and control and therefore fail to fully explore positions and perspectives. In these discussions, physicians objectively share medical information but refrain from expressing their personal experiences and recommendations, ostensibly to enhance the patient’s power to make an independent choice. Dialogues that enhance autonomy engender a different dynamic between physician and patient; their primary objective is to achieve as full an understanding of the meaning of the problem as possible. The assumptions, values, and perspectives of both participants are fully explored.

The enhanced autonomy model allows the physician to support and guide the patient’s decision making without surrendering the medical power on which the patient depends. The independent choice model assumes
that if the patient is to gain power to make autonomous choices, the physician must correspondingly lose power. The enhanced autonomy model understands that power in the physician-patient relationship is not a zero-sum quantity. Accepting the physician's power to offer recommendations--while obligating the physician to fully understand the patient's reasoning when those recommendations are rejected--enhances rather than reduces the patient's power and competence.

By taking the risk of informing patients about their own feelings, values, and recommendations, physicians can deepen and enrich medical decisions so that they are both personal and professional. All medical decisions have value-laden consequences and thus should be made in the context of a multidimensional exchange of ideas, values, feelings, and experiences between physicians and patients. The physician is as much guide and fellow traveler as technician and medical expert. The spirited exchange that characterizes joint decision making by persons who care deeply about the patient's outcome, described in the enhanced autonomy model, is a far cry from both the coerciveness of paternalism and the remoteness of the independent choice model. Final choices belong to patients, but these choices gain meaning, richness, and accuracy if they are the result of a process of mutual influence and understanding between physician and patient.

AUTONOMOUS DECISIONS: OBSTACLES

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Autonomy is one of the main principles of biomedical ethics and refers to the rights of patients to refuse or choose their treatment. In the field of intensive care medicine, this seemingly basic principle can and does come with significant controversy. Equipping patients with the right to dictate treatment when they are not equipped with knowledge of intensive care is problematic. Critically ill patients are often unable to make decisions. The very concept of patient autonomy is not widely accepted in some cultures, including several in Asia. This talk will thus focus on the obstacles to autonomous decisions in the intensive care unit.
WHY BOTHER - AUTONOMY IS OVERRATED!

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Any notion of moral decision-making assumes that rational agents are involved in making informed and voluntary decisions. In health care decisions, our respect for the autonomy of the patient would, in common parlance, imply that the patient has the capacity to act intentionally, with understanding, and without controlling influences that would mitigate against a free and voluntary act. This principle is the basis for the practice of informed consent in the physician/patient transaction regarding health care. In a prima facie sense, we ought always to respect the autonomy of the patient. Such respect is not simply a matter of attitude, but a way of acting so as to recognize and even promote the autonomous actions of the patient.

But in ICU setting .. What is the patients medical problem:- Is the patient mentally capable and legally competent, and is there evidence of incapacity?- If incapacitated, has the patient expressed prior preferences?- Who is the appropriate surrogate to make decisions for the incapacitated patient? -Is the problem acute? Critical? Reversible? Emergent? Terminal?Are we still thinking and talking about Autonomy here? What are the goals of treatment?

Can we accept here to by pass the first step of those Four commonly accepted principles of health care ethics, excerpted from Beauchamp and Childres(2008)?
SEPSIS IN LOW AND MIDDLE INCOME COUNTRIES

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In industrialized nations, efforts like the Surviving Sepsis Campaign have favorably impacted the recognition and management of sepsis, and its outcomes, for many patients and patient populations. These improvements are predicated on the high reliability performance of standardized tasks that promote earlier condition recognition as well as earlier provision of standardized treatments (care bundle). In industrialized nations, lack of resource availability related to sepsis care is a lesser issue (e.g., ICUs, laboratory and imaging support, medications, trained personnel), and generally has less (negative) impact sepsis care and outcome. In developed countries, what seems to have the greater impact is how personnel (teams) respond and train, as opposed to access to resources. In emerging nations, there are significant differences regarding the recognition and treatment of sepsis. First and foremost, resource availability is an issue and can be a major impediment. The surviving sepsis bundle becomes less relevant when you lack the technology and/or resources to accomplish specific sepsis bundle elements (e.g., measuring the serum lactate concentration, administration of necessary antibiotics, access to life support supplies like endotracheal tubes or central line catheters). Clearly, support of related organ system dysfunction is also beyond the scope of practice for many ICUs in these settings. Second, in emerging nations prevailing infection control practices can adversely impact the proper care for patients with sepsis. For example, access to ICU medical supplies can be severely limited (e.g., CVC catheters, ET tubes, ventilator circuits), and these are commonly re-used, in many locales and contribute to a high incidence of ICU nosocomial infection. Third, in emerging nations access to proper ICU staff education can also be limited. This is not simply book knowledge about sepsis, but team behaviors, communications, infection control, and so forth. Finally, owing to sociopolitical viewpoints and circumstances, ICU and other care providers in emerging nations may not acknowledge sepsis as a reversible condition, and may choose not to provide any treatment some/many patients. Addressing this problem requires public and governmental buy-in, that is, education of the non-medical community regarding deficiencies, potential solutions, potentially available treatments and expected outcomes. Relevance to the Surviving Sepsis Campaign: The Surviving Sepsis Campaign (SSC) was not designed to function in the non-industrial nation environments described above. While the issues in providing care have been delineated and clear goals have been provided, the relevance and practicality of the approaches championed by the SSC may be limited in emerging and developing nations. Given that sepsis is extremely prevalent in these locales it is logical to address how these differences in circumstances and focus affect care delivery and to develop a program that more precisely addresses the needs of patients with sepsis in emerging nations.
Sepsis, colloquially known as blood poisoning, is a syndromic response to infection and the final common pathway to virtually all deaths from infective diseases of all origins worldwide. Despite medical progress with use of better vaccines, antibiotics and acute care, hospital mortality rates of sepsis in the best healthcare systems in high income countries range between 10 and 50%.

Accurate data on the incidence of sepsis in low and middle income countries are virtually nonexistent, however, if we extrapolate from data in high income countries conservative estimates suggest more than 30 million new sepsis cases throughout the world each year. At least 8 million people including 5 million neonates and young children die from sepsis more than two million of these deaths are preventable. In some countries sepsis is ranked as the most expensive medical conditions accounting for approximately 3% of the national health care expenditures. The costs related to long-term impacts of sepsis have not been quantified but are likely substantial, including subsequent medical care. Despite its remarkable incidence and high mortality rate, sepsis is largely unknown to the general public, media and even health care officials. Most people are ignorant of the early signs and symptoms of sepsis. It is poorly known that every acute infection may progress to life threatening sepsis for which an effective cure requires not only treatment of the underlying infection but rigorous acute care interventions to stabilize the cardio-respiratory system and other organ functions. Lack of awareness and knowledge about sepsis have disastrous results: a) Loss of lives and health because lay people delay seeking appropriate medical care, b) Health care professionals miss the diagnosis and delay treatment, c) Inadequate documentation of sepsis in the WHO International Classification of Diseases system by health care providers, d) Insufficient consideration of sepsis in health care planning and resource allocation by national and international health care authorities.

For those reasons the Global Sepsis Alliance and the World Sepsis Day movement request:

- WHO and the United Nation Member States support the implementation of the necessary guidelines and strategies for the reduction of incidence of, and mortality from sepsis
- To provide the necessary support for the development of scientific research related to the prevention, diagnosis and treatment of sepsis;
- To improve the assessment of global and regional economic impact and estimate the human and fiscal burden of sepsis
- To support, as appropriate, resource-constrained Member States in conducting events to mark World Sepsis Day
- To mobilize international organizations, financial institutions and other partners to give support and assign resources in the strengthening of prevention and control programmes, diagnostic and laboratory capacities, and the management of sepsis to developing countries in an equitable, most efficient, and suitable manner

CHALLENGES OF AND OPPORTUNITIES FOR LARGE COLLABORATIONS

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WHAT IS DEATH BY NEUROLOGICAL CRITERIA, AND WHAT IT IS NOT?

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**CHANGING INTERPRETATIONS OF DEATH BY NEUROLOGIC CRITERIA: THE MCMATH CASE**

**David Crippen**  
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In December of 2013, a young girl, Jahi McMath underwent tonsil surgery at UCSF Benioff Childrens Hospital Oakland to correct sleep apnea. She subsequently suffered severe hemorrhagic complications, inability to maintain a patent airway leading to cardiac arrest, anoxic encephalopathy and was later declared brain-dead by two neurologists using the standard criteria in December 2013. Her family, however, disagreed with the diagnosis of death by neurologic criteria and desired the patient continue receiving aggressive medical support. The child's family retained an attorney and went to court to prevent the hospital from removing the ventilator. She was ultimately transferred to a private skilled nursing facility where today her condition remains unknown.

Erstwhile medical experts plied in the media. Pediatrician Paul A. Byrne, MD, publically opined that Jahi was not truly dead since every cell in her brain was not dead. Robert Veatch, PhD, a prominent medical ethicist publically stated that the parents of Jahi McMath should get to choose their own definition of death based on their personal religious and cultural views.

There are emerging issues. Either the determination of death by neurologic criteria is factually in error and the patient is NOT dead, or the passion of the family to see and feel what clearly cannot be true has reached truly astounding levels. Bioethicists and physicians cannot even among themselves come to a consensus that there is only one kind of death and whether the neurologic criterion can certify it. The public has grown increasingly suspicious of the diagnosis of death in a warm, pulsating, ventilating body with all the appearances of viability. The public, especially the American public is steeped in the tradition of personal autonomy such that if they can decline treatment, they want to be able to demand it through an attorney.

The courts have now served notice that they do not understand the concept of Total Brain Failure. There seems to be some controversy thereof even among physicians and so the path of least resistance is to let the most convincing court argument prevail. To the court, life or what passes for it is a safer bet than death. The propensity for families to request continuance of artificial organ support for brain dead patients has now been very publicly set and there are a whole lot of prospective surrogates out there that now know they can defeat a diagnosis of death by neurologic criteria.

ICUs could see a substantial increase in dead patients on ventilators waiting interminably for a long shot cure. Skilled Nursing Facility (SNF) beds would swell with such patients and become as scarce as the financial resources available to support them. The number of organs available for transplantation would decrease measurably.
TOWARD A NEW PARADIGM IN DEATH: CONSCIOUSNESS

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The traditional determination of death based on the irreversible cessation of circulation has been rendered insufficient in the modern era. Life support interventions can maintain organic function almost indefinitely, which leads us to ask: when is a person dead and why, and how can we prove it has occurred? This session will examine the traditional biological definition of death and consider whether bodies diagnosed with Total Brain Failure satisfy it.

An analysis of what death is must precede any discussion of the legitimacy of the diagnostic criteria. Traditionally the definition of death and the means to test for it were one and the same: death occurred when the heart and lungs stopped because without exception circulatory failure indicated death. With the advent of technology, specifically cardio pulmonary resuscitation, mechanical ventilators, and Intensive Care Units, vital signs could be maintained despite the fact that the individual would never regain consciousness. While the continuation of life absent a subject to experience it was possible, it was not acceptable and a second criterion of death emerged.

The determination of death on neurologic criteria also known as Total Brain Failure was thus developed, which allowed for death to be declared (and, as it happened, for organs to be procured) even in the presence of circulation and spontaneous heartbeat. Unfortunately, many complex problems would arise since a justification was not given for why a dead brain would be equivalent with a dead human being. Years later a rationale would be supplied that death was the irreversible cessation of the integrated functioning of the organism as a whole. This meant that when biological functions were not directed and controlled by the brain but by life support systems such functions were regarded as un-integrated and the organism as a whole was dead despite appearances to the contrary.

It became clear, however, that bodies determined dead on neurologic criteria continued to engage in a range of activities including respiration, circulation, gestation of a fetus, and maintenance of neurohormonal pathways among others. The persistence of these functions raises serious doubts that such bodies are actually dead according to a biological model that focuses on organic integration.

While a body that has been determined dead on neurologic criteria has no hope of recovery it is not necessarily dead on biological grounds. This session will explore how the neurologic criterion of death can be maintained if we expand our definition of death from a biological model to an ontological one that considers the primacy of consciousness.
MUST DEATH BY NEUROLOGIC CRITERIA BE IRREVERSIBLE?

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Before the postmodern technological revolution, determination of death was simple: a patient was dead when his or her physician said they were dead. No one was timing death because it didn’t matter. Death was a terminal event. There was never any intent to reverse it. However, the age of organ transplantation has radically changed the entire concept of death. We, as a society, have decreed that a person can be dead but the corpse still contain otherwise viable organs. Rather than death being defined as irreversible loss of cellular function, (a definition that would involve a putrefaction), death became modified to irreversible cessation of the integrated functioning of the organism as a whole.

There is controversy regarding the point at which the brain is dead enough to meet criteria for the dead donor rule. Death of the whole organism is not required for the organism to be pronounced dead; only the brain need be dead. Without this definition, the industry of organ transplantation would be impossible because putrefaction of the whole organism would be the only benchmark of death.

Accordingly, brain death protocols have evolved to medically and legally identify patients dead enough to bury but with organs viable enough for transplantation. The Uniform Determination of Death Act (1981) has served as a model statute for states adopting legislation defining death. The act asserts two possible definitions of death: An individual who has sustained either irreversible cessation of circulatory and respiratory functions, or irreversible cessation of all functions of the entire brain, including the brain stem, is dead.

However, there is a difference between a diagnosis of death and a prognosis of death. In brain death, any decompensation that will eventually result in death of the brain can be considered a prognosis of death but cannot serve as a diagnosis. If the heart suddenly stops pumping blood, the brain will surely die in time, but isn’t necessarily dead at the time the blood flow ceases. By the rules, the person is not dead till the brain is irreversibly dead—death by neurological criteria.

The idea that brain death is equivalent to death is now internationally established and codified. Debates continue over how much brain function must be irreversibly injured for a diagnosis of brain death to be made and whether there is more than one kind of death. These considerations show that the precise moment when death occurs cannot be accurately pinpointed and raise the issues of whether there is a practical or ethical difference between being dead, being almost dead, or being in the process of dying.
DRUGS OF ABUSE

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Legal and illegal drugs are abused around the world and often result in significant morbidity and mortality requiring critical care. Despite the wide variety of abused drugs, patients usually present with clinical syndromes or toxidromes that can be described as mellow, sympathomimetic, narcotic or sedative/hypnotic.

The typical mellow toxidrome is associated with marijuana usage. Marijuana is the most commonly abused drug world-wide but does not often result in significant injury requiring critical care. The sympathomimetic toxidrome is characterized by tachycardia, hypertension, tachypnea, hyperthermia, agitation, dilated pupils, diaphoresis and sometimes seizures. Drugs of abuse associated with this syndrome include cocaine, amphetamines/methamphetamines, and phencyclidine, as well as newer drugs such as bath salts, synthetic marijuanas, and N-Bomb. The mainstay of managing acutely intoxicated patients is sedation with benzodiazepines which can be administered intravenously or intramuscularly. Gastric emptying is not usually indicated. Due to the agitation and physical activity, volume resuscitation should be initiated in most patients while further evaluation is initiated. It is important to choose laboratory and imaging studies to assess for complications. Complications of sympathomimetic drug abuse may include arrhythmias, acute coronary syndromes, seizures, intracranial hemorrhage, stroke, rhabdomyolysis, renal failure, and hyperthermia. Newer drugs of abuse such as bath salts, synthetic marijuanas and N-Bomb may result in more agitation and aggressive behavior and require higher doses of benzodiazepines for management. These newer drugs are not detected in routine urine toxicology screens.

A narcotic syndrome may result from intoxication with prescription or illegal opioids. Abuse of prescription narcotics has been increasing but deaths due to heroin abuse are also rising. The classic clinical findings of narcotic overdose include respiratory depression, decreased level of consciousness, and miosis. Heart rate and blood pressure may also be decreased. Naloxone is the antidote but the appropriate dose must be selected in order to reverse toxic effects. Higher doses (up to 10 to 20 mg) may be required to reverse synthetic agents and long-acting agents. The goal of naloxone treatment is reversal of respiratory depression not complete arousal. Once respiratory depression is reversed, a continuous infusion of naloxone can be used to prevent resedation.

Sedative/hypnotic toxidromes are characterized by hypotension, bradycardia, depressed level of consciousness, respiratory depression, and hyporeflexia. Common drugs of abuse that are associated with these findings include ethanol, benzodiazepines, and gamma hydroxybutyrate. Management of these intoxications is primarily aimed at airway protection and ventilatory support. Although flumazenil can reverse the effects of benzodiazepines, it is not routinely recommended in overdosed patients as the short half-life of flumazenil may result in resedation. In addition, flumazenil use may precipitate seizures in patients who use cyclic antidepressants or chronically use benzodiazepines.
TOXICOLOGIC USE OF INTRAVENOUS LIPID EMULSIONS

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Intravenous lipid emulsion (ILE) has been used as a source of parenteral nutrition for over 40 years. Since the initial successful report for use in acute bupivacaine-induced cardiac arrest in 2006, ILE was subsequently successfully used in several reported human cases of cardiovascular collapse from local anesthetic overdose. The predominant theory of the lipid sink phenomenon makes this therapy potentially applicable for a wide variety of lipid-soluble xenobiotic-induced toxicities, including calcium channel blockers and tricyclic antidepressants.

Several professional societies have provided guidelines for the use of ILE in a setting of local anesthetics systemic toxicity, including the American Society of Regional Anesthesia and Pain Medicine (ASRA) and the Association of Anesthetists of Great Britain and Ireland (AAGBI). The use of ILE for local anesthetics induced cardiac arrest is also mentioned in the 2010 American Heart Association guidelines for cardiopulmonary resuscitation. The American College of Medical Toxicology (ACMT) interim guideline on lipid resuscitation therapy in 2011 opines that there is currently no standard of care requirement for the use of lipid emulsion therapy, but that a treating physician may consider the use of this therapy for circumstances of serious hemodynamic instability resultant from lipid-soluble xenobiotics.

The suggested dosing regimen is as follows: 1) an initial intravenous bolus administration of 20% LE (1.5 mL/kg) is followed by a continuous infusion of 20% LE (0.25 mL/kg/min); and 2) when hemodynamic functions are unstable after the initial LE infusion, an intravenous administration of 20% LE (1.5 mL/kg) is repeated and followed by an increased continuous infusion of 20% LE (0.5 mL/kg/min). Twenty percent formulation is preferred than 10% ILE formulation, because the higher concentration of free phospholipid in the 10% formulation interferes with lipoprotein lipase activity.

Literature on the use of ILE in humans remains sporadic and is largely limited to case reports. Unfortunately, the lack of high-quality controlled human trials and substantial publication bias toward positive results precludes lipid emulsion therapy as a first-line agent for indications other than local anesthetic systemic toxicity. About 15% among reported case reports described no clinical improvement after administration of ILE. Lipid emulsion is also associated with improvement for poisoning from several water-soluble xenobiotics and substances with unknown partition coefficients such as aconite and glyphosate. Therefore, other mechanisms of ILE are proposed including enhanced metabolism theory and activation of ion channels. The mechanisms of action of ILE in toxicology are not yet clearly understood.

As ILE is increasingly used for less severe cases of drug toxicity, clinicians should be aware of potential complications associated with its use such as clinically relevant pancreatitis and acute respiratory distress syndrome. Administration of ILE may interfere with the clinical laboratory measurements such as complete blood count and electrolytes. Therefore, ILE should be considered in a life-threatening systemic toxicity situation due to a lipophilic drug with a riskbenefit assessment on a case-by-case basis.
WHY MEDICAL MATTERS SHOULD BE DECIDED BY MEDICAL EXPERTS

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Because we pay homage to the desires of autonomous patients and customer service, rejecting the evils of paternalism, there is a significant incidence of inappropriate admissions to ICU care. The big question regarding open-ended care remains as a significant issue in worldwide distributive justice: we, as a global village are unclear what to do about patients and/or their surrogates demands for increasingly expensive and prolonged care at the end of life. Many patients and surrogates opt for aggressive palliative care when it becomes clear that technology cannot cure but can only protract the dying process. There is, however, an accumulating number of patients and surrogates have an unrealistic understanding of what ICU interventions can actually accomplish, causing intractable conflicts at the bedside.

Several reasons have been offered for surrogates demanding inappropriate (if not futile) care. Physicians do not have an admirable track record of predicting death; there is thus always the potential for unexpected survival. The Internet and popular media with poorly authenticated opinions from pseudo-experts has become the new resource for families seeking more optimistic data. The ethical principle of autonomy is increasingly cited as a justification to demand otherwise futile interventions, believing that any chance for life is better than no chance. Surrogates make decisions embracing a long-shot cure.

There are a number of stock replies to the assertion that individuals should have authority to demand disproportionate ICU resources at the expense of the whole population. Numerous publications and focus groups have extolled communication as a way to get surrogates to do the right thing, but virtually all of these groups stop short of supporting saying no to inappropriate care. Even when this excessive use of medical resources does occur, the money spent is inconsequential compared with the total expenditures on health care. Saying no is synonymous with death panels in terms of hastening the death of old, sick people to save money.

Many such issues have not yet been addressed or are too socio-politically volatile, arousing too many special interest groups to permit consensus as described earlier in the context of explicit rationing policies. One issue, however, is certain: the most expensive resource in the hospital, intensive care, is now complicated by a global financial crisis that is directly affecting the delivery of health care worldwide.

If and when the marginal facility profit for expensive intensive care inverts, such that hospitals lose money on every ICU admission, administrators will take a much harder look at inappropriate care. These decisions left to the whims of administrators rather than medical professionals. The only reliable way to stop patient demands for futile care is to develop and enforce macro-management maxims that set objective limits. Limits based on accumulating global databases capable of accurately predicting outcome, and thus defining outcome futility on the basis of objective bedside physiologic data.
WHY PATIENTS AND THEIR FAMILIES SHOULD HAVE THE LAST WORD

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The traditional model of the doctor-patient relationship was the paternalistic beneficience model. The patient is passive, and unable to make wise choices. The physician knows best and makes all decisions. There has been a significant shift from the beneficence model to the autonomy model. The autonomy model is founded on the assumption that given adequate information, a patient will make an informed decision consistent with his or her sense of well-being, free from controlling interference. When several treatments are available, the best trade-off between benefits and risks depends on the patients perceptions and consequently must be decided by the patient. Similarly, whether treatment limitation decisions are appropriate depends on whether the quality of life that would be obtained after survival is acceptable to the patient, even when that decision conflicts with a physicians recommendation. The right of a patient to make decisions at the end of life (e.g., advance directives) is now well-established and ethically justified by the principle of respecting patient autonomy.

In the ICU, patients are often cognitively impaired, and families are asked to speak for them. The family is in the best position to express the patients wishes, represent his values and preferences and defend the patients best interests. Thus autonomy is transferred to the family. However families may not always have a clear understanding of the scientific problems involved, and their emotional distress may limit their ability make objective decisions. They may experience difficulty in separating what they feel is best from what they believe the patient would think is best. Finally, some family members may make decisions that defend their own best interests rather than the patients.

The shared decision model combines the advantages of the paternalistic and autonomy models, by allowing patients or families to contribute to the extent that they can, while receiving guidance from the healthcare team. The healthcare staff could give a clear description of their opinions, based on professional experience and on what they believe is in the patients best interests to initiate discussions with patients or families. Some families may prefer to make most medical decisions, including those at the end of life; others let physicians assume complete responsibility. However, in everyday practice, sharing decisions may also be difficult. Differences in personal values often seem to underlie conflicts between physicians and families, along with family refusals to accept the prognoses provided to them.

Family members are the ones most affected by severe illness and death of their loved ones, and are at risk for pathological grieving, depression, posttraumatic stress disorder, and death. They must be involved in the process that will allow them to understand why a particular decision is in the best interests of their loved one. In both curative care and palliative care, only daily information and effective communication can allow families to understand and accept that the decision made collegially by the ICU team is the best possible one. The shared model, with all its good points, must still be improved.
DIFFICULT AIRWAY MANAGEMENT: POOR DECISIONS OR LACK OF TECHNICAL KNOWLEDGE?

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The management of difficult airway requires intensive training, knowledge and experience. This is a required skill in many professions, mainly in anesthesiology, critical care and emergency medicine. Patients with difficult airway that develop progressive respiratory failure or are in acute respiratory distress may die if mistakes are made during these first crucial seconds or minutes.

The objectives of this lecture include:
1) Increase awareness about airway management challenges outside the operating room
2) Identify the limitations of some of the conventional airway management algorithms
3) Propose strategies to respond more effectively in these cases

We will review decisions versus techniques used to manage a series of critically ill patients; then, we will offer solutions based on the lessons learned and make recommendations to improve practice.
HOW CAN WE INCREASE THE SAFETY OF TRACHEAL INTUBATION IN CRITICALLY ILL PATIENTS?

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Tracheal intubation is a routine procedure in the intensive care unit (ICU), and is often life saving. However life threatening complications [1] including severe hypoxia, cardiovascular collapse, aspiration, difficult intubation, oesophageal intubation, and death occur in a significant proportion of procedures, making tracheal intubation (TI) perhaps one the most common but underappreciated airway emergencies in the ICU.

In contrast to the controlled conditions in the operating room (OR), the unstable physiologic state of critically ill patients along with under evaluation of the airways, presence of relatively inexperienced staff, and sub-optimal response to preoxygenation are the major factors for high incidence of life threatening complications. Studies have shown strategies planned for TI in the OR can be adapted and extrapolated for the use in the ICU. TI performed or supervised by experienced doctors is associated with fewer complications. The MACOCHA score [2] identifies seven predictors of difficult intubation in the ICU: Patient Mallampati score III or IV, obstructive sleep apnea syndrome, reduced mobility of cervical spine, limited mouth opening, pathology (severe hypoxia, coma) and operator (nonanesthesiologist). Non-invasive positive pressure ventilation (NIPPV) for preoxygenation provides adequate oxygen stores during TI for patients with precarious respiratory pathology.[3] High flow nasal cannula oxygen during the apneic period may decrease hypoxic events during intubation.[4]

The intubation procedure should include not only airway management, but also hemodynamic, gas exchange and neurologic care, which are often crucial in critically ill patients. The National Audit Project-4 from the United Kingdom has emphasised that capnography must be used to confirm initial and continued tracheal placement of endotracheal or tracheostomy tubes.[5] Adherence to a plan for difficult airway management incorporating the use of videolaryngoscopes, intubation aids is useful, and all intensivists must be familiar with rescue airway techniques. Intubation failure or predicted difficulty should lead to alternatives such as NIPPV or tracheostomy.

There is a necessity for the implementation of an Intubation Bundle during routine airway management in the ICU.[6] Elements of the bundle include presence of two operators, fluid loading (in the absence of cardiogenic pulmonary edema), preoxygenation for 3 min with NIPPV in case of acute respiratory failure, rapid sequence induction using etomidate 0.2to 0.3 mg/kg or ketamine 1.5 to 3 mg/kg combined with succinylcholine 1 to1.5 mg/kg (in absence of contraindications to its use), Sellick maneuver, immediate confirmation of tube placement by capnography and infusion of norepinephrine if diastolic blood pressure remains low.

Acquiring knowledge and expertise and adherence to defined strategies and algorithms can resolve most problems in airway management in the ICU.
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PERCUTANEOUS TRACHEOSTOMY

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Percutaneous tracheotomy (PT) is an option of airway management for prolonged mechanical ventilation in intensive care unit (ICU). It is an alternative to surgical tracheotomy in this patient group. It is safe, and relatively easy to apply at the bedside in the ICU. It can be done by the intensivist, which gives freedom to the intensivist in airway management.

There are several techniques for percutaneous tracheotomy. All of them operationally start with Seldinger technique which is also used during venous or arterial access. A cannula is inserted into the trachea by the guidance of air suctioning through it. The second or third intercartilage membrane in the midline is the area of insertion. After J guide wire is inserted into trachea through this cannula, the hole of the guide is enlarged with several methods. This may be a forceps, a screw, nephrostomy type dilatators and one dilator which enlarges gradually. At the end a tracheotomy cannula uploaded to a special straightener and placed in to the tracheal lumen through this stoma. This procedure also can be done similarly to retrograde intubation. In which the guide of Seldinger technique inserted to trachea in the direction of the mouth. The tracheotomy cannula is placed through mouth into the tracheal lumen by this route with the guidance of the guide.

The most famous techniques are known as Ciaglia technique or Griggs technique at least in my country.

The complication rate for this procedure was equal or less than surgical tracheotomy. Complications are insertion failure, tracheal tube misplacement, bleeding, infection, pneumothorax, subcutaneous emphysema, and death. The total complication rates range 3-25% versus 6-66% for surgical tracheotomy. To improve its safety it can be combined with bronchoscope or ultrasound usage. This is especially important in the learning period of the operator. Besides the issues mentioned above the speed of performance which is 1-20 minutes and being done in the ICU without necessitation of transport to the operating room are advantages of PT.

The contraindications are cervical fracture, infection in the area of tracheostoma, bleeding disorder.
The tracheostomy in the critically ill patient has experienced significant changes in the last years since the rise of the percutaneous methodology.

The tracheostomy is a commonly used procedure in Intensive Care Units nowadays, however several aspects have been changing overtime since the inception of the percutaneous tracheostomy, such as: indications, timing and techniques. While there is abundant literature on the topic, it is considered inconclusive and there is no real consensus about it.

For this reason, in 2014, the FEPIMCTI decided to carry out a consensus of experts on the topic of Tracheostomy in the critically ill patient. To this end, a group of experts from member countries was appointed to review the existing literature and reach conclusions that could be considered evidence as per the GRADE scale (GRADE is a methodology used to grading the quality of evidence and strength of recommendation in the health care).

The methodology used for building the consensus guidelines consisted of three steps: First, defined the topics to be analyzed for which the experts identified a series of questions. Second, provided experts with access the most current databases so that they could review the pertaining literature, answer the questions with levels of evidence. Third, consolidated the input provided by the experts to develop the final consensus guidelines and conclusions.

Over this process, used systematic revisions / Meta-analysis and primary studies (clinical trials, case studies and controls, cohorts and case-series).

The purpose of this presentation will be to summarize the considerations of the methodology used and the most relevant conclusions obtained through this consensus.
THE FOREIGN MEDICAL TEAMS PROCESS, A TOOL TO IMPROVE QUALITY AND COORDINATION OF TRAUMA CARE FOLLOWING DISASTERS

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The number of Foreign Medical Teams, FMTs deployed to countries affected by sudden onset disasters has increased. Following the 2010 Haiti earthquake 390 FMTs were registered, after Haiyan the 2013, Philippine typhoon 108 FMTs were deployed during the first month. FMTs have been criticized for being too trauma care oriented, arriving too late and not being willing to be coordinated. The WHO led FMT initiative aims at improving FMT performance. Classification and standards for FMTs have been published and the next step is registration and adherence to the standards. The professional medical bodies such as trauma societies are encouraged to provide inputs to define evidence based technical standards. This presentation is a state of the art introduction to how FMT performance can be improved in upcoming disasters, focusing on trauma care.
THE ICU IN DISASTER

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During this presentation we will review:

- Historical Perspective of ICU in Disasters
- Obsolete recommendations from Centers for Disease Control with high-consequence pathogens
- What SARS taught us in 2003
- Principles of ventilator triage in mass casualty events
- Evidence of contamination with high risk for aerosolization
- Tricks of the trade in Dallas 2014 with Ebola Virus Disease - using appropriate Personal Protective Equipment in the ICU
ICU TRIAGE: THE MD ANDERSON CANCER CENTER MODEL

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Triage is the process of sorting patients to prioritize medical services based on their medical condition’s severity. It is a difficult and complex process that occurs every day in conflicts around the world. Objective criteria for dynamic decisions are lacking and the process is affected by a great deal of subjectivity and the experience of the triage officer.

Triage was born during the Napoleonic wars over 200 years ago; the military continues to have the biggest use and more experience in this process. Civilian organizations use it mostly in disaster situations, however, intensive care units, emergency rooms, and other don’t have much everyday experience with this challenging process.

In this lecture,

1) We will review the triage process developed and implemented at MD Anderson Cancer Center Intensive Care Units a few years ago

2) We will discuss the benefits and obstacles of the model

3) We will make recommendations based on the lessons learned
EXPERIENCES FROM HAITI EARTHQUAKE 2010 AND THE 2013 PHILIPPINES TYPHOON

Johan von Schreeb
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This presentation will share systematically collected data on the need for trauma and emergency care following the two disasters. In addition the speaker will share experiences from on ground work as a trauma surgeon in the disasters for Medecins Sans Frontieres (MSF). Additional information on how rapidly set up disasters response teams should be organized and equipped in order to adequately address the main health problems in disasters.
INDUSTRIAL ACCIDENT (FUKUSHIMA)

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The National Police Agency reported that across Japan 15,889 people were killed, 2,597 are missing, and 6,152 were injured due to the Great East Japan Earthquake of 2011.

The characteristics of this disaster are as follows,

Vast extensive range of residence area was washed-out by the huge tsunami

Infrastructure damage was also very wide spread

Severe shortage of fuel throughout the Tohoku region

Devastating damage to local government that were in charge of local health system

Some hospitals and clinics were totally swallowed by tsunami

Huge numbers of mortality, missing and evacuees

Small number of severe trauma cases

Many shelters in the submerged area

Nuclear power plant accident

Before the Japan tsunami disaster the Japanese government had developed the National Disaster Medical System (e.g. Designated Disaster Base Hospitals, Disaster Medical Assistance Teams, the Wide-Area Disaster & Emergency Medical Information System, and the Wide-area Medical Evacuation System) which was established according to the lessons learned from the Great Hanshin-Awaji Earthquake.

A large number, 383 teams, 1,852 personnel, of Disaster Medical Assistance Teams (DMATs) were dispatched from all over Japan to the area affected by the Earthquake. They assisted the Designated Disaster Base Hospitals, were engaged in medical evacuation of severe cases and carried through some total evacuations from hospitals devastatingly damaged. In terms of the ultra-acute phase medical care, the Japanese National Disaster Medical System worked adequately.

However, we experienced another challenges on this disaster. There were very few trauma and also few severe cases. Among the very few trauma, only 10% were triaged as category I. Number of patients on the first day was few, and rapidly increase from the third day. 70-80% of increased needs were medical maladies.

The Japanese National Disaster Medical System had been developed focusing on life saving medical management on severe trauma and crush syndrome. In the Japan Tsunami disaster, however, we had to cope with quite different medical needs.

Evidence shows that large-scale disasters would cause excess morbidity and mortality by indirect impact throughout all the phases of disaster response, especially among the vulnerable and high-risk populations in
shelters and temporary housing, as the Great East Japan Earthquake-related deaths exceeded 3,000 as of end September 2013. The majority of these indirect death are caused by delay of non-clinical public health interventions (such as food sanitation, environmental hygiene, infection control, nutritional assessment, support for people requiring special care). The public health response left lots of lessons learned.

Public health response requires a continuum of measures from early phase of life saving to the later phase of disease prevention and health system reconstruction. Critical elements of this response are planning, information management, capacity building, and coordination among various parts of public health response and with medical and other sector response.

Based on lessons learned from the disaster, more specific priorities and detailed action plans in public health sector should be reflected in the Japanese National Disaster Medical System.
EBOLA OUTBREAK

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MSF (Médecins Sans Frontières), Japan

Since the first outbreak of Ebola in Democratic Republic of Congo in 1976, Medecins Sans Frontiéres (MSF), Doctors Without Borders in another name has been contributing to control those outbreaks. However the outbreak in 2014 was unprecedented and all the countermeasures were one or more steps behind, then all the international health authority as well as MSF were overwhelmed. WHO reported that 26,628 confirmed cases and 11,020 deaths up to 3rd of May 2015. Number of cases in this outbreak is more than the number of accumulative cases of 20 outbreaks since 1976. In this outbreak, virus transmitted in urban area with large population. All three countries including Liberia, Sierra Leone, and Guinea were the countries that never experienced Ebola before. These are thought to be the reasons of this unprecedented outbreak.

MSF set up 8 Ebola Management Centre with more than 325 international staff and 4150 national staff. 8,100 cases were admitted to those centres and ended up 5,000 confirmed cases and 2,300 survivors.

MSF conducted 50,000 home disinfection and protection kit distribution. 1.8 million malaria treatments were distributed.

In MSF Ebola Management centres, overall case fatality rate was 51.8%. Under 5 and over 60 years old showed the case fatality rate of 67% and lowest case fatality rate of 43% was in age group of 5-29 years old.

Tremendous load of patients and the significantly high risk of infection with needle stick injury were the obstacles for MSF to have serological data. That is why number of cases examined for serology was small, but there are some considerable data.

Level of Cycle threshold by PCR showed that case fatality rate of patients with cycle threshold of lower than 18.0 was 100%.

Creatinine of above 442μmol/L showed 86.7% of CFR.

AST of above 400μmol/L indicated higher CFR of 54.5% compare with AST below 399μmol/L showed below 20% of CFR.

On 9 May 2015, WHO declared Liberia free of Ebola virus, although the new cases are still being reported from Guinea and Sierra Leone. Apart from brutality of this virus, those three countries are known as the countries with poorest health structure as some important heath indicators including infant mortality rate, under 5 mortality rate, and maternal mortality ratio indicates. Many health care providers were killed by Ebola. Economical Damage of these countries from this outbreak is immeasurable. To rebuild up these countries, long term support is essential. At the same time, we should not forget the weakness and stagnancy of international aid activity revealed by this outbreak, which we learned in exchange for thousands of death.

On top of MSF Ebola intervention, I would like to introduce MSF critical care programmes in resource poor settings.
WFSICCM RESPONSE TO DISASTERS

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HEART-LUNG INTERACTIONS

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The hemodynamic effects of ventilation can be grouped into four clinically relevant concepts. First, spontaneous ventilation is exercise. In patients increased work of breathing, initiation of mechanical ventilatory support will improve O2 delivery to the remainder of the body by decreasing O2 consumption. Similarly, patients who fail to wean often manifest cardiovascular insufficiency during weaning attempts (1). One way to assess cardiovascular reserve is to see if the patient is volume responsive, those who are wean more often than those who are not (2).

Second, changes in lung volume alter autonomic tone, pulmonary vascular resistance, and at high lung volumes compress the heart in the cardiac fossa similarly to cardiac tamponade. As lung volume increases so does the pressure difference between airway and pleural pressure. When this pressure difference exceeds pulmonary artery pressure, pulmonary vessels collapse as they pass form the pulmonary arteries into the alveolar space increasing pulmonary vascular resistance. Hyperinflation increases pulmonary vascular resistance impeding right ventricular ejection. Both spontaneous ventilation that induces dynamic hyperinflation and rapid mechanical breaths that cause auto-PEEP can induce acute cor pulmonale. Decreases in lung volume below functional residual capacity also increases pulmonary vasomotor tone by the process of hypoxic pulmonary vasoconstriction (3). Recruitment maneuvers that restore alveolar oxygenation without over distention will reduce pulmonary artery pressure.

Third, spontaneous inspiration and spontaneous inspiratory efforts decrease intrathoracic pressure augmenting venous return but also increasing left ventricular afterload (4) and can induce acute cardiogenic pulmonary edema. Mechanical ventilation, by abolishing the negative swings in intrathoracic pressure will selectively decrease left ventricular afterload, as long as the increases in lung volume and intrathoracic pressure are small (5).

Finally, positive-pressure ventilation increases intrathoracic pressure. Since diaphragmatic descent increases intra-abdominal pressure, the decrease in the pressure gradient for venous return is less than would otherwise occur if the only change were an increase in right atrial pressure (6). However, in hypovolemic states, it can induce profound decreases in venous return. Increases in intrathoracic pressure decreases left ventricular afterload and will augment left ventricular ejection. In patients with hypervolemic heart failure, this afterload reducing effect can result in improved left ventricular ejection, increased cardiac output and reduced myocardial O2 demand (7).

References
MONITORING RESPIRATORY EFFORT AND WORK OF BREATHING BY DIAPHRAGMATIC EMG

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The breathing effort required by the patient is often increased due to increased elastance and resistance or by the presence of intrinsic positive end-expiratory pressure. While the effort generated by the ventilator is easily measured at bedside, the measurement of the effort generated by the patient is more difficult to measure, but certainly not less relevant.

MONITORING BREATHING EFFORT BY ESOPHAGEAL PRESSURE

Esophageal pressure (Pes) is the gold standard method to measure the pressure generated by respiratory muscles (Pmusc) in individuals and it is applicable also in patients undergoing spontaneous assisted breathing. However it still suffers from some unavoidable (for time being) technical difficulties, that make its routine use still rather rare in clinical practice.

MONITORING BREATHING EFFORT BY DIAPHRAGMATIC ELECTROMYOGRAM

The relationship between diaphragmatic pressure and the diaphragm electromyographic signal has been described in physiology for decades. Recently, the monitoring of the electrical activity of the diaphragm (EAdi) has been introduced in clinical practice to drive the ventilator during neurally adjusted ventilatory assist. It provides, however, an excellent form of diaphragmatic activity monitor, during any type of ventilation.

EAdi is linearly related to Pmusc, but the slope of this relationship is different between patients and at different times.

It is possible however to calculate in each patient and at any time the Pmusc/EAdi ratio (Pmusc/EAdi index PEI) during a simple end-expiratory occlusion. The PEI indicates how much pressure (in cm H2O) the respiratory muscles of the patients are generating for each mV of electrical activity.

The potential relevance of monitoring EAdi, as a proxy of Pmusc, during the weaning process has also been shown.

In addition to the value of EAdi, two recent studies underlined the clinical relevance of neuroventilatory efficiency (i.e. the ratio of Vt to EAdi, which expresses the ability of generating volume normalized to neural drive). The neuroventilatory efficiency, however, is affected by several factors, including the efficiency of translating EAdi into pressure and the efficiency of translating pressure into flow and volume (i.e. the mechanical properties of the respiratory system).

Finally it is possible to titrate the ventilatory support to achieve a given EAdi value, targeting approximately 60% of the value recorded in the absence of any ventilatory assistance: as a consequence of the linear relationship between EAdi and Pmusc, it is possible to titrate the ventilatory assistance to achieve a given breathing effort.

Among others methods, diaphragmatic electromyography appears therefore particularly promising, as mV can be easily and continuously translated into cm H2O at bedside.
CHEST WALL MECHANICS

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How lightly should we sedate mechanically ventilated patients?

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PAD guidelines figured out the burden of what we currently faced, and provided an evidence-based framework on preventing and treating pain, agitation, and delirium in mechanically ventilated patients. Out of those updated suggestions and recommendations, maintaining a light sedation target was considered as the predominant contribution of the PAD guidelines.

Actually, over sedation were commonly generated in our clinical practice because of frequently non-protocoled administration of sedatives, lack of tightly monitoring the depth of sedation, and even a shortage of nurses as well. As demonstrated in previous publications, light sedation strategy could successfully prevent mechanically ventilated patients from over sedation, and has been significantly associated with improved clinical outcomes. However, several questions remained to be answered for clinical implementation of this strategy. First, PAD guidelines did not help to determine the indications for light sedation. Reported by a RCT, only 38 (10.8%) out of 352 consecutive admissions with mechanical ventilation were qualified to be assigned into the arm receiving a goal directed light sedation strategy (RASS -2 to +1). Second, the safety of light sedation was under-investigated. In Shehab’s current publication, delirium was diagnosed in 228 of 354 of patients (64.4%), who were maintained at a target of RASS -2 to +1. Moreover, self-extubation was reported more frequently in those cases receiving early goal-directed sedation. Third, little was known about the detrimental effects secondary to inappropriate light sedation such as high stress response, which was likely the important source of PTSD.

In general, light sedation is beneficial to some, but no all of mechanically ventilated patients. Patient-centered individual target rather than RASS-2 to +1 might be the optimal level of sedation for mechanically ventilated patients.

Keywords: Light sedation, Question, Patient-centered individual target
Adequate delivery of oxygen to tissue is a primary goal for patients with ARDS. The lung protective ventilation strategy (tidal volume of 6 mL/kg of predicted body weight, plateau pressure less than 30 cm H2O) is strongly advocated. Moreover, a few studies suggested that tidal volumes should be lowered even at plateau pressures <30 cm H2O, as lower plateau pressures associated with lower mortality rates. On the other hand, a recent study suggests that the lung protective ventilation is beneficial only if associated with decreases in driving pressure ($\Delta P = \text{plateau pressure minus PEEP}$), indicating the importance of lung recruitability in patients with ARDS. To enhance gas exchange and avoid atelectotrauma, positive end-expiratory pressure (PEEP) can be applied, although large multicenter trials using higher levels of PEEP in conjunction with low tidal volumes did not show benefit. In a recent study, however, a hyperinflammatory phenotype of ARDS with a higher prevalence of sepsis had lower mortality and less organ failure using high PEEP strategy. Taken together, we our clinicians should apply ventilator settings such as tidal volume, PEEP and recruitment maneuver and prone position also by response.
LUNG PROTECTIVE VENTILATION - PUTTING ALL THE LAB AND CLINICAL EVIDENCE TOGETHER

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Numerous experimental studies demonstrate the potential for adverse patterns of mechanical ventilation to initiate acute lung injury that is characterized by proteinaceous edema, inflammation, and hemorrhage. The great majority of these investigations into ventilator-induced lung injury (VILI) have focused on the characteristics of the individual tidal cycle i.e., tidal volume, inspiratory flow rate, airway driving pressure, and end-expiratory airway pressure (PEEP). Although these features are of unquestioned importance, laboratory work has demonstrated that other characteristics of the clinical environment modify the intensity and/or nature of the resulting damage.

In the largest and perhaps the most widely cited clinical trial of ventilator strategy in acute lung injury yet undertaken (ARDSnet ARMA), smaller tidal volumes were associated with reduced mortality. This result was initially attributed to the reduced stretch, as lower peak alveolar pressures and reduced mechanical stresses associated with smaller tidal volumes. Analysis of the data pooled from both trial groups not only demonstrated a positive correlation between plateau pressure and mortality rate, but also revealed its monotonic, linear nature without an obvious break point down to pressures that are considerably lower than those that are feasible to use in the management of ARDS. Such observation underscores the need to identify any cofactors that influence VILI expression. A recent retrospective (and as yet unconfirmed) re-analysis suggests that the difference between plateau and PEEP (the driving pressure, rather than the static plateau pressure itself) may be the mechanical factor greatest impact.

Although less well studied, lung injury arising in the course of mechanical ventilation may also relate to such non-ventilatory factors as body position, PaCO2, acid-base state, pulmonary vascular pressure changes, body temperature, concomitant pathologies, and pharmacologic agents. These non-ventilatory factors are amenable to modification at the bedside. Recent randomized clinical trials that appear to have puzzling results may well be explained by the mechanical and non-mechanical factors documented in laboratory experiments.
LUNG-BRAIN INTERACTIONS IN CRITICALLY ILL PATIENTS RECEIVING MECHANICAL VENTILATION

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Multiple organ failure is the main cause of morbidity and mortality in acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) patients. Moreover, survivors of both ALI and ARDS often show significant neuropsychological decline at discharge. These data suggest a deleterious organ crosstalk between lungs and distal organs. This article reviews the recent literature concerning the role of this organ crosstalk during ALI, ARDS and mechanical ventilation (MV), especially focusing on brain-lung communication. Numerous pulmonary and extrapulmonary disorders could predispose critically ill patients to ALI and ARDS. Mechanical ventilation, although a lifesaving intervention, could contribute by modulating mechanisms involved in the pathophysiology of lung damage and their impact on remote organs. Emerging clinical and experimental evidence supports the hypothesis of a multidirectional organ crosstalk between lungs and distal organs. Organ crosstalk is an emerging area of research in lung disease in critically ill patients. The findings of these studies are clinically relevant and show the importance of an integrative approach in the management of critical patients. However, further studies are necessary to understand the complex interactions concurring in these pathologies.
VENTILATOR WAVEFORM ANALYSIS IN DECISION MAKING

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Graphic waveforms for displaying pressure, flow and volume over time are now available on the great majority of mechanical ventilators and are likely underutilized. This underutilization may be related to failure to integrate teaching of waveforms in critical care training curriculums. Likewise graphic waveform displays are likely underutilized in teaching programs for imprinting basic concepts of mechanical ventilation (for example, using waveforms to explain the difference between continuous positive airway pressure and positive expiratory pressure). Pressure, flow and volume waveforms over time are essential for teaching the different types of mechanical ventilator breaths and how these are put together to create modes of mechanical ventilation. Teaching the concept of how tidal volume is controlled in pressure control ventilation relative to increases in pressure versus increases in time can likely only be adequately explained with the use of waveform display. Using waveforms for differentiation of breath allows one to do the following: demonstrate that a pressure control breath is controlled by pressure, cycled by time and therefore a pressure controlled, time cycle breath. Waveforms allow reinforcement of the independent variables of pressure control as time and pressure and the dependent variables being flow and volume. Likewise a volume breath has flow as the control variable for inspiration, is volume cycled and is called a flow controlled, volume cycle breath. The independent variables are flow and volume and the dependent variables are pressure and time. Finally a pressure support breath has pressure as the controlled variable and differs from pressure control breaths in having flow as the cycling mechanism. Like pressure control it is a pressure controlled flow cycle breath. Unlike pressure control the only independent variable is pressure and the dependent variables include flow, time and volume. Examples of use of ventilator flow waveforms include: (a) demonstration of a concave inward distortion of the inspiratory pressure waveform in patients who have inadequately low inspiratory flow setting during delivery of volume breath (b) demonstration of stability of end expiratory pressure waveform measurement with end expiratory hold on pressure waveform setting (c) teaching the concepts of partition of compliance between lung and chest wall when esophageal pressure measurements are added to flow volume and airway pressure over time (d) detecting the importance of inspiratory effort during pressure control ventilation using neuromuscular blockade as a teaching component for the concept and using pressure regulated volume control as an active patient example (e) loading effect of sudden changes in lung compliance on pressure reaction in a pressure regulated volume control mode or pressure controlled volume guarantee mode.
SPONTANEOUS VENTILATION AND ARDS

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Acute respiratory distress syndrome (ARDS) is associated with a high morbidity and mortality. The optimal ventilation strategy for ARDS patients is still unclear. Recent data supporting neuromuscular blockade muscle and controlled volume ventilation needs to be weighed against the postulated benefits of preserved spontaneous breathing. Both strategies have advantages and disadvantages. Randomized controlled trials in acute phase ARDS suggest a 2-day infusion of cisatracurium decreases mortality in the most severely hypoxemic patients. In the less severe patients (mild ARDS), however, the benefits of preserving spontaneous breathing with an improvement in oxygenation and a decrease in the length of mechanical ventilation, have also been demonstrated.

In ARDS patients, driving pressure appears to be associated with increased mortality. True driving pressure includes not only the plateau pressure minus the total PEEP, but also the negative pressure of patient generated diaphragmatic excursion. Modes that allow spontaneous breathing (e.g. PSV, APRV or ASV) may result in of uncontrolled larger tidal Volumes with a masked true driving pressure, are a reason for concern. In spontaneous breathing patients the measurement of transalveolar pleural pressure, by oesophageal balloon or other techniques, may guide a safer ventilation strategy. Monitoring of not only plateau pressure and tidal volume but also trans pulmonary pressure seems crucial to understanding spontaneous ventilation in ARDS sufferers.
All patients surviving mechanical ventilation need to be weaned from the ventilator. In this regard, the issue of optimizing weaning from mechanical ventilation is of major importance. This process, however, covers a very wide spectrum, from a simple test before extubation in patients with a high pre-test probability of successful weaning, to prolonged global and ventilatory management in specialized centres for some of the most difficult patients. Pathophysiology and management considerably differ across the different situations. To help separating quite distinct situations, a classification of weaning into simple, difficult and prolonged situations had been proposed. Simple weaning refers to patients separated at first attempt and involves a good approach in systematic screening; difficult weaning is represented by patients requiring several attempts, up to one week and necessitates a good understanding of weaning failure pathophysiology; prolonged weaning refers to the small group of patients requiring at least one week of weaning and in whom the global management is essential. Applying this classification to a large and recently collected cohort study aiming at describing the distribution of the different weaning categories, we had to face the issue of the complexity of the way weaning is conducted in real life. The simple schema of a spontaneous breathing trial followed by a decision for extubation and a successful outcome is not encountered in almost half of the situations. A new classification had to be redesigned to better address this reality. This new classification allows a complete description of patients submitted to mechanical ventilation. It also allows for the first time to describe the impact of the key weaning steps on the prognosis of patients deemed ready to be submitted to a weaning process. It shows for instance that the risk of death is multiplied by three in patients who do not succeed their first attempt at weaning.
DIAPHRAGM DYSFUNCTION DURING WEANING: SIGNIFICANCE AND TREATMENT

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Difficulties in discontinuing ventilatory support are encountered in 20-25% of all mechanically-ventilated patients. Approximately 40% of total ventilation time is spent for weaning. The diaphragm, the principal respiratory muscle, is susceptible to various insults such as hypotension, hypoxia, and sepsis. In addition, mechanical ventilation itself can induce diaphragmatic dysfunction (DD) by decreasing the force-generating capacity of the diaphragm, referred to as ventilator-induced diaphragmatic dysfunction. Despite these facts, however, the prevalence and clinical significance of DD in medical ICU patients are not yet clear.

The difficulty of studying DD is related partly to the cumbersome nature of the current diagnostic tools available. Fluoroscopy of the diaphragm, the roentgenographic method, requires transportation of patients that entails considerable medical risk. Moreover, it is often impractical to impose fluoroscopic maneuvers such as sniffing on critically-ill patients. Phrenic nerve conduction study, another frequently used method, elicits unpleasant sensation in the subject, and can only detect abnormalities in neural conduction, which does not necessarily mean dysfunction of the diaphragm muscle. Unlike these conventional methods, ultrasonography (US) has a few important advantages that make it a suitable diagnostic tool for critically ill patients. US is devoid of radiation hazards, available at the bedside, and thus precluding the need of transportation. Moreover, the US exam for the diaphragm gives functional information about the muscle itself, and can be repeated if follow-up is required.

Several US techniques have been used to assess diaphragmatic movement, including B-mode, M-mode, and measurements of changes in diaphragm thickness. Among these, M-mode US is the easiest to perform and showed high correlation coefficients between and within observers. The M-mode US is also recently shown to be capable of quantifying diaphragm movements. Recently, a few studies are reported about the usefulness of this technique in evaluating diaphragmatic function and predicting weaning from mechanical ventilation in the medical ICU. In our own study, diaphragmatic dysfunction as diagnosed by US was common in ICU patients. Patients with such diaphragmatic dysfunction showed greater difficulty in weaning than patients without. In patients with diaphragm dysfunction, unilateral dysfunction is more common than bilateral. Patients with diaphragmatic dysfunction showed frequent early (primary) and delayed (secondary) weaning failures.

For optimization of diaphragm function, partial ventilator support is preferred over full ventilator support. And all efforts should be done to decrease the duration of mechanical ventilation. With regard to PEEP, setting PEEP at unnecessarily high level should be avoided as shortening of the muscle due to excessive PEEP may aggravate disuse atrophy of the muscle. Besides ventilator strategies, nutrition, anabolic agents and antioxidant supplementation can be considered. Pharmacologic agents such as theophylline and caffeine are known to exert inotropic effects on the diaphragm. Medication such as corticosteroid, aminoglycosides, neuromuscular blockers are best avoided.
INTERACTION BETWEEN SEDATION AND WEANING: HOW TO BALANCE THEM?

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A good number of patients in the ICU are mechanically ventilated. Weaning, the process of liberating the patient from the ventilator is often hindered or totally prevented by the concomitant use of Central Nervous System (CNS) depressant drugs, like sedatives and opioid analgesics. Criteria for weaning include resolution of the underlying cause of respiratory failure, hemodynamic stability, adequate neurological status, adequate gas exchange, and absence of fever. An additional feature to initiate the traditional weaning process was the absence of sedative therapy. This approach was valid for weaning techniques such as the spontaneous breathing test, the t-tube and the pressure support methods. Currently weaning in patients who need some form of sedation accounts probably for about 30% of all weaning attempts (those patients not successfully weaned at first attempt). Weaning should be considered as early as possible, a daily screening for readiness to wean and a formal weaning protocol should be implemented in every ICU.

All patients in the process of weaning should be periodically assessed to identify and treat pain, since pain could produce anxiety and agitation. Likewise agitation and delirium should be systematically assessed with validated scales and treated with non pharmacological methods or sedative drugs. Unfortunately sedatives which act via GABA ergic pathways affect respiratory drive and or timing. Benzodiazepines, propofol an opioids may cause patient/ventilator asynchrony prolonguig the weaning process. Use of longer acting sedative drugs should be avoided particularly benzodiazepines, however its abrupt termination is not advised and a step down strategy should be considered, utilizing shorter acting drugs like propofol. The use of benzodiazepines is associated with worse clinical outcomes when compared with either propofol or opioid based sedation regimens. Administration of benzodiazepines is associated also with transitioning into delirium.

Sedative and analgesic drugs with minimal or no effects at all on respiration have prompted the concept of weaning with cooperative sedation. Dexmedetomidine and remifentanil at very low dose, are short acting drugs which can be titrated in a continuous infusion, and are particularly well suited to provide both analgesia and ansiolysis in patients during the weaning process, while meeting the goal of minimal/awake sedation. Dexmedetomidine may induce a sedative state similar to physiologic sleep without respiratory depression by acting on a2 agonists in the locus caeruleus. At comparable sedation levels, dexmedetomidine treated patients spent less time on the ventilator and experienced less delirium compared with the midazolam group. Although the use of dexmedetomidine is promising further RCT are needed to determine its real value in the ICU patients.
NEW INSIGHTS ON TRACHEAL EXTUBATION AFTER DIFFICULT WEANING

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Prolonged weaning from mechanical ventilation, defined as more than 7 days from the first spontaneous breathing trial to achieve successful weaning is a relevant clinical issue. It occurs in approximately 20% of patients who had attempts to be weaned from the ventilator, and these patients exhibit markedly different outcomes as compared to simple weaning patients (those extubated after successfully passing the first spontaneous breathing trial). As compared to simple weaning patients, those needing a prolonged weaning from mechanical ventilation have longer length of ICU and hospital stay, increased morbidity (reintubation rates and tracheostomy rates) and higher mortality rates.
Severe trauma is associated with several disorders, including those of the airway, respiratory, circulatory, and central nervous systems. As trauma shock caused by massive bleeding is especially lethal, it must be assessed and treated rapidly. Primary survey is performed for all patients with severe trauma according to the Japan Advanced Trauma Evaluation and Care in Japan. Chest and pelvic radiographies, and focused assessment with sonography for trauma (FAST) are highly important for detection of the bleeding origin in the chest or abdomen. Moreover, serum lactate level is also useful to detect the presence of severe hemorrhage. Immediate detection of massive bleeding and initiation of therapeutic intervention are essential for the survival of patients with severe trauma. We use the doctors car (DC) to deliver early treatment for patients with severe trauma. In our trauma center, if necessary, massive transfusion and operation can be ordered before the patients arrive at our trauma center. Resuscitative thoracotomy (RT) may be performed before cardiac arrest prior to hospital arrival. Aortic cross clamping may be performed to avoid cardiac arrest. If the patient transported to our trauma center by the DC is unstable, shock, resuscitative operation (thoracotomy or laparotomy) and massive transfusion are immediately performed in the emergency department. Resuscitative operation is started at an average of 16 minutes after the patients arrival. To control abdominal or pelvic bleeding, RT is performed via anterolateral thoracotomy. If necessary, clamshell thoracotomy is additionally performed. Release of cardiac tamponade; control of lung, heart, and chest wall bleeding; and cardiac massage for resuscitation are also achieved by RT. If FAST results are positive and the patients condition is unstable, resuscitative laparotomy must be performed immediately. Crash laparotomy is performed, and hemostasis is achieved immediately. Damage control surgery (DCS) must be decided before the deadly triad emerges. The mortality of patients who present with the deadly triad is 86.7%. If necessary, both operation and trauma interventional radiology (IVR) are performed simultaneously in a hybrid trauma room. Hemostasis performed during the surgery and IVR is effective for reducing hemostasis time. Abbreviated surgery must be completed rapidly, followed by immediate intensive care. If the patients condition in the ICU is unstable, emergency reoperation must be performed in ICU because of unstable patients. Damage control resuscitation must rapidly be performed with DCS. Permissive hypotension and hemostatic resuscitation using massive transfusion should be performed from prehospital treatment by DC. The training of resuscitation skill is also important. We developed an original trauma surgery training program called the Surgical Strategy and Treatment for Trauma (SSTT) including surgical skill, strategic decision making, and development of teamwork with nurse. SSTT as an off-the-job training is useful for proper execution of resuscitation in patients with severe trauma. For the survival of patients with trauma accompanied by massive bleeding, it is extremely important how the trauma surgeon stops the bleeding fast. We must establish a system for initiating early therapeutic medical intervention, including resuscitative operation, from before arrival at the hospital to admission at the ICU.
The concept of a thoracotomy as a resuscitative measure began with Schiff’s promulgation of open cardiac massage in 1874. Since then, the utility of the emergent thoracotomy has being tested in a wide range of clinical scenarios.

Emergency department thoracotomy (EDT) is defined as a thoracotomy performed in the emergency department for patients who are in extremis. In the resuscitation of severely injured patients, emergency department thoracotomy (EDT) is performed as a salvage procedure for selected patients who arrive in extremis or who arrest shortly before or after arrival. The primary goals of EDT are to release pericardial tamponade, control cardiac hemorrhage, control intrathoracic bleeding, treat massive air embolism, perform open cardiac massage, and temporarily occlude the descending thoracic aorta.

While the usefulness of EDT in resuscitation of the patient in profound shock but not yet dead is unquestionable, its indiscriminate use renders it a low-yield and high-cost procedure. Numerous studies suggested a selected approach to its use in the moribund trauma patient, based on consideration of the following variables: location and mechanism of injuries, signs of life at the scene and on admission to the emergency department, cardiac electrical activities at thoracotomy, and systolic blood pressure response to thoracic aortic cross-clamping.

Overall analysis of the available literature indicates that the success of EDT approximates 35% for the patient arriving in shock with a penetrating cardiac wound and 15% for all patients with penetrating wounds. However, patient outcome is relatively poor when EDT is performed for blunt trauma, 2% survival for patients in shock and less than 1% survival for patients with no vital signs.

Despite of the obvious fact that EDT offers the only chance for survival to patients in extremis, the reported survival rates after EDT are very low except penetrating injuries. We should be armed with knowledge of survival predictors and the risks associated with the resuscitation of critically injured patients, and decide when to proceed with EDT in patients who have a chance of survival.
TOWARDS HEMOSTATIC RESUSCITATION

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There is sparse data regarding the optimum method of blood and blood replacement during hemorrhage. Much of the practice is based on retrospective studies, small randomized trials, and or expert opinions. Several advances in hemostatic resuscitation have been studied, and although many do not have high level evidence, the trend is towards using multi-model protocols or algorithms to keep abreast of a bleeding patient. Massive transfusion protocol emphasizes early product infusion rather than waiting on laboratory values. Each hospital may have variations to their massive transfusion protocol but the principle is similar: with 1:1:1 (1 red cell, 1 FFP, and 1 platelets) infusion to optimize immediate hemostasis. The automated release of blood and blood products by blood bank may impact survival, and decrease crystalloid requirements with secondary complications of abdominal compartmental syndrome and oxygenation failure.

Other blood product are used for specific indications: Prothrombin Complex, Cryoprecipitate. Pharmacologic agents include anti-fibrinolytics (tranexamic acid), factor VIIa, desmopressin. Topical agents for intra-operative control are expanding.

Point of care assessment of coagulation is possible using PT, aPTT, or viscoelastic assays (TEG, ROTEM). Availability of these tests assists with identifying specific coagulation abnormality leading to earlier and more goal directed hemostasis.
WHY WE NEED A WORLD COALITION FOR TRAUMA CARE

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Trauma remains a major public health problem worldwide. Intentional and unintentional injuries occur in high- as well as in low- and middle-income countries, leading to deaths and millions of disabled individuals. No other disease has had such an impact on individuals, on families, and in society. Interestingly enough, recognizing traumatic injury as a disease, using a disease management model, and providing organized and comprehensive care through the development of trauma systems decreases mortality by 25% and markedly reduces the burden of the disease.

No other disease process has been affected so much by the organization and implementation of care systems. Although we all recognize trauma as the number one killer between the ages of 1 and 45 years worldwide, it was only until recently (August 2012) that the world came together during the first World Trauma Congress to learn, debate, and discuss not only modern management strategies, but also to acknowledge our individual and the collective responsibility of many international trauma societies to advance knowledge, clinical care, prevention, strategies, and systems development.

A collective decision was made that our professional trauma organizations should remain engaged and continue the work initiated in the first World Trauma Congress by creating the World Coalition for Trauma Care (WCTC) (http://www.worldcoalition-trauma-care.org), with the intent to organize and promote the WTC in perpetuity. The agreement was to gather every 2 years around the WTC, always linked to the annual meeting of one of our participating trauma organizations. There are currently more than 70 national trauma professional organizations participating in the WCTC. Our commitment is to continue advancing and disseminating knowledge, implementing prevention strategies, developing trauma systems, and, more importantly, sharing with each other our experiences and successes. In addition, WCTC member societies recognize their responsibility in helping and supporting low-income countries in their regions to advance trauma care.
LIFE THREATENING CHEST INJURIES

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Damage Control Surgery in the chest has evolved differently from Damage Control in Abdominal Injuries. However, the principles from which the techniques have developed from are the same: abbreviated surgery which may or may not necessitate a return to the operating room for definitive surgery. The aim of Damage Control in chest injuries is mainly for haemorrhage control and the surgery by itself is often definitive. The availability of staplers, various energy devices and haemostatic agents has also made it easier to abbreviate thoracic surgery.

The following damage control procedures and techniques will be briefly discussed:

- Emergency Room Thoracotomy
- Cardiac Stapling
- Cross Clamping of the Aorta
- Pulmonary Twist / Hilar Clamping
- Non-anatomical Resection of Lung
- Tractotomy
- Use of staplers, energy devices and haemostats
- Thoracic Packing
- Temporary Thoracic Closure
DAMAGE CONTROL IN ABDOMEN AND PELVIS INJURIES

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The traditional approach to abdominal trauma is not applicable in devastating injuries. Repeated episodes of hypotension and organ hypoperfusion will lead to severe metabolic acidosis, coagulopathy, and hypothermia that persist during the postoperative period despite adequate surgical treatment of multiple injuries. In these circumstances, the operative procedure must be interrupted in an attempt to stabilize the patients physiology prior to definitive repair. Damage control includes an abbreviated laparotomy and temporary packing and temporary closure of the abdomen used as an effort to blunt the physiologic response to prolonged shock and massive hemorrhage. During the initial operation bleeding and contamination are controlled using temporary measures. The abdomen is packed, temporarily closed, and reconstruction and repair are delayed. The patient is then transferred to an intensive care unit to be further resuscitated and rewarmed, acidosis and coagulopathy are corrected, and full physiologic support is instituted. When the patient is stable and organ function is maintained, usually 24-48 hours after the initial operation, the patient is taken back to the operating room for packing removal, debridement of non viable tissue, and definitive repair.

The same concept applies to severe pelvic trauma. Patients with complex pelvic fractures and significant hemodynamic instability may undergo pre-peritoneal pelvic packing and external fixation followed by angioembolization to control bleeding, then transported to the ICU for physiologic stabilization, and back to the OR for packing removal and definitive management of the pelvic fracture. IN patients with exanguinating open pelvic fractures, the pelvis may be packed through the perineal lacerations once intraabdominal injuries have been ruled out, prior to going to angiography and embolization.
ADVANCES IN TRAUMATIC BRAIN INJURY TREATMENT

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Traumatic brain injury is common and is one of the most common reasons for death and disability in trauma. Penetrating traumatic brain injury is often thought to be lethal as published studies have shown that the survival rates are as low as 10%. This is often due to the feelings that if the brain has been injured that the meaningful survival rates are low. It is also thought that aggressive treatment of penetrating injury to the brain will result in life long disability and a burden to society. However with an aggressive approach the survival rates can be as high as 47%. This high survival rate is achieved with current resuscitative methods and diligent critical care. Methods to increase survival include aggressive resuscitation efforts with blood products to achieve normal blood volumes and to treat coagulopathy which is common. Drugs to combat coagulopathy is also used which was previously withheld. The use of prothrombin complex concentrate has been shown to be effective and rapid. In addition patients also become hemodynamically unstable during the herniation phase which often results. During this phase of care, the use of hormonal therapy with thyroid hormone has helped manage these patients before brain death. While the survival rates were increased with aggressive management which includes early surgery, the rates of organ donation increased even though the pool of donors decreased with less patients dying. These methods of therapy will be discussed.

In the realm of blunt traumatic brain injury, we have found that the diagnosis of intracranial injuries have been remarkably increased in recent years. This is probably attributable to the widespread use of CT scans to the head. The trigger for obtaining a CT scan has increased and the advancements in CT technology has identified small intracranial injuries. This increase in diagnosis has led to a huge resource drain on the health care system. In developed trauma systems, these patients are transferred to trauma centers for management. Since there are currently no guidelines for the management of mild traumatic brain injuries we have developed the Brain Injury Guideline which delineates as to who has minor TBI and which patients have moderate or severe TBI. The need for this is amplified by the fact that more patients are on anticoagulants along with the fact that the population is aging. This has added to the burden of shortage in resources. With the huge increase in the diagnosis of TBI, increasing age of trauma patients and the high prevalence of the use of anticoagulants, the management of TBI is becoming a drain in hospital resources. The current standard for the management of patients with intracranial bleeds and injuries found by CT scan of the head is to admit the patient to an intensive care unit with serial CT scans to identify who will progress in their injury and who can safely be discharged. The developed Brain Injury Guideline has tackled this problem and the implementation of these guidelines has shown that the savings to the patient and the health care system can be enormous. Finally the management of TBI in patients that are on anticoagulants is complex. The use of platelets, fresh frozen plasma and prothrombin complex concentrates has been shown to safely reverse the coagulopathy with earlier neurosurgical therapy and better outcome. In additions there are potential post injury treatments that are promising using remote ischemic preconditioning and the preliminary results of this research will be discussed as well as the future research to further delineate the usefulness of this non invasive technique.
FLUID RESUSCITATION: WHERE WE ARE

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The first principle of shock resuscitation irrespective of etiology is to achieve euvoemia. Major problems in clinical medicine are: 1) the endpoint of fluid and blood resuscitation is determined by surrogate markers instead of measuring intravascular volume and red cell volume, and 2) most ICUs do not utilize tissue perfusion monitors which would allow titration of oxygen delivery (DO2) to meet tissue demands. Problems associated with fluid resuscitation to static pressures such as central venous pressure (CVP) and pulmonary artery occlusion pressures (PAOP), are well recognized. There has been increasing interest in variability in the cardiovascular system (Stroke volume variation, pulse pressure variation) to determine cardiac responsiveness to fluid infusion but whether this impacts outcome is not known. The best estimate of circulating intravascular volume should be to measure volume which has historically been technically difficult. The bedside measurement of blood volume has been simplified by a semi-automated technique for measuring circulating blood volume (BVA-100, Daxor, NY, NY) using I-131 tagged albumin. This allows for measurement of plasma volume, red cell volume, and total circulating blood volume. We present data on: 1) discrepancy between clinical judgment and the measured blood volume, 2) and how using blood volume analysis to guide fluid and red cell treatment may impact mortality.
HOW TO USE ANTIBIOTICS IN ABDOMINAL INJURY PATIENTS?

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The use of antibiotics in abdominal injury patients has resulted in decreased infection rates. Post-trauma SIRS make physicians resist to shortening antibiotics therapy. Actually sometimes we experience clinically significant infectious complications. These subsequent complications, however, are due to progression of the original disease or inadequate original source control and may not be preventable with antimicrobial therapy alone.

The use of antibiotics should be considered according to injury site, grade of injury, time-gap to operation and completion of source control. Prophylactic antibiotics should be optimally administered prior to incision and the duration should be brief (within 24 hours) with complete source control. However, in severely injured patients, we should consider the altered pharmacokinetics of drugs in patients undergoing resuscitation with crystalloid and blood products. Moreover, past decades the practice of damage control laparotomy became widely used, and additional questions arose as to the role of prophylactic antibiotics in this setting.

Relevant areas for future investigation include the safety, convenience, and cost-effectiveness of available antimicrobial regimens for lower-risk patients, and better means for identifying and treating higher-risk patients with intra-abdominal infections.
ECMO SUPPORT IN TRAUMA PATIENTS

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Advanced treatments in trauma care are needed to modify the actual therapeutic strategy and treatment protocols. Since the first successful application of ECMO (extracorporeal membrane oxygenation) in a patient with trauma, performed by Donald Hill in 1972, it has been widely used in various conditions and has proven to be effective in shock status and pulmonary failure, even when standard therapies have failed. ECMO is one of the promising equipment in rescue of patients who are severely injured by multi-trauma. However, the need for anticoagulation to prevent clot formation in the circuit has not allowed the widespread use of ECLS in patients with polytrauma, mostly because of multiple injuries and increased risk of bleeding. Recently, advances in anticoagulation management, including heparin-bonded circuits, have reduced the risk of bleeding complication, and a few clinical reports have documented successful treatment in trauma patients. Percutaneous cannulation and double-lumen catheters enable less-invasive and faster procedures that are suitable for emergency situations.

There has been the general agreement about the effect on short-term outcomes of normothermic ECMO for donation of abdominal organs for transplantation after cardiac death (DCD). Since a traumatic mechanism of injury is present in a high proportion of patients who eventually become organ donors, the trauma surgeon can play an important role in the donation process. Trauma surgeons can play an important and integral role through the recognition and referral of potential organ donors. Educational programs specifically directed toward trauma physicians and the institution of ECMO protocols or expansion of existing ECMO programs could potentially increase the donor pool by upwards of 35%. While the majority of our organs came from Maastricht III patients, we plan to expand our selection criteria to include Maastricht I, II, and IV patients if the duration of cardiopulmonary arrest in the field is short.

We expect that ECMO can provide a sufficient cardiac and pulmonary support in various cases of trauma fields, unresponsive to conventional resuscitation and also allow time for maintenance and recovery for further treatment.

Reference

LACTIC ACIDOSIS: 1780 TO 2015

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Lactic acid is generated through anaerobic glycolysis when the Krebs Cycle is not capable of providing adequate oxygen for metabolism of pyruvic acid. The lactic acid is buffered and measured as lactate in the blood (arterial or venous as well as capillary as point of care only). Lactate was discovered in sour milk in 1780 by Karl Scheele and first reports of lactate in sepsis were in 1843. There are two types of lactate production; type A (tissue hypoperfusion with anaerobic glycolysis) and type B (other). Type A is associated with tissue hypoxia and hypoperfusion and recently has gained much attention in severe sepsis. It is long been known that improvement in type A lactic acidosis correlates strongly with survival. Type B (aerobic) lactic acidosis is seen in the absence of tissue hypoxia or hypoperfusion and characterized by a wide variety of causes including congenital metabolic disorders, hepatic disease (decreased clearance), acute leukemia and drugs. Presence of lactate in sepsis may be multifactorial and in addition to anaerobic glycolysis may be cytokine driven (increased cellular glucose uptake) or catecholamine induced sodium-potassium pump activity increase. Aerobic hyperlactatemia is seen with impaired pyruvate dehydrogenase activity, thymine deficiency and alkalosis. Drugs that cause type B hyperlactatemia include epinephrine, metformin, cyanide, methanol, and nucleoside reverse transcriptase inhibitors.

Point of care lactate analyzers have proven to be accurate but because of the influence of in vitro glycolysis should be analyzed within fifteen minutes or stored at less than 4 degrees centigrade. Use of venous tourniquet is acceptable. The Hepatosplenic area is not a common source of lactate in patients with severe sepsis. Between 2004 and 2014 patients with lactate >4 were considered preferentially treated with Early Goal Directed Therapy including a CVP target of 8-12 mm Hg and an ScvO2 saturation target of > 70%. With the recent publication of the ProCESS and ARISE trials it is now recognized that CVP and ScvO2 targets are not preferential to alternative resuscitation regimens. Several studies have demonstrated the ability of protocolized lactate clearance being an appropriate resuscitation target in sepsis induced tissue hypoperfusion (persistent hypotension following initial fluid bolus or lactate >4). In the end the question of cause and effect of lactic acidosis on outcome must be questioned. Lactic acidosis is likely a sign of tissue hypoxia and wherein the correlate to poor outcome and not the cause. Data from patients with shock would indicate that equamolar amounts of sodium bicarbonate vs sodium chloride produce the equivalent effect on ability to wean vasopressors.
SHOCK AND TISSUE HYPOXIA

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EARLY GOAL DIRECTED THERAPY -
WHAT DID THE BIG TRIALS TEACH US

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SHOCK: FROM DIAGNOSTIC TO THERAPEUTIC IMPLICATIONS

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Circulatory shock is a life-threatening syndrome resulting in multiorgan failure and presenting a very high mortality rate. In 2006, an international consensus conference (ICC) was held in Paris to develop guidelines for the hemodynamic management of patients with shock and implications for management.

At that time, a jury of 11 persons representing five critical care Societies attended the presentations of 25 experts in the field of shock. Experts were asked to address several specific questions posed by the conference organizers and scientific advisors such as:

(1) What are the epidemiologic and pathophysiologic features of shock in the intensive care unit (ICU)?
(2) Should we monitor preload and fluid responsiveness in shock?
(3) How and when should we monitor stroke volume or cardiac output in shock?
(4) What markers of the regional and micro-circulation can be monitored, and how can cellular function be assessed in shock?
(5) What is the evidence for using hemodynamic monitoring to direct therapy in shock?

Despite the large majority of prior attempts to define hemodynamic instability in shock commonly mention the presence of specific clinical findings suggesting hypoperfusion, with experts for years have proposed as an initial step in the evaluation of patients with shock a thorough physical examination with the attempt to identify clinical findings such as hypotension, tachycardia, altered mental status, delayed capillary refill, decreased urine output, and cooled skin and extremities.

Such clinical findings form an integral part of many of the current definitions for different types of shock. Some of the clinical findings that are most commonly quoted as being useful are the presence of hypotension, delayed capillary refill, and temperature changes in the skin or extremities.

Shock results from poor tissue perfusion and oxygenation, with microcirculatory inadequacy to sustain tissue oxygen needs, leading to cellular dysoxia. This can be defined as ATP flux decreasing in proportion to oxygen availability, with preserved ATP demand. In critically ill patients, tissue hypoxia is due to inadequate or disordered regional distribution of blood flow both between and within organs. Therefore, therapy in shock should be aimed, at least in part, at restoring an adequate organ perfusion pressure. Inadequate perfusion leads to the generation of lactate and hydrogen ions which spill over into the bloodstream, leading to the biological profile of lactic acidosis. Despite obvious limitations, the plasma level of lactate remains a good surrogate for inadequate tissue perfusion in shock. In particular, the progressive reduction of plasma lactate and correction of acidosis probably reflects the restoration of organ blood flow.
While the definition of shock developed through this consensus process is consistent with available data, the jury acknowledges that there is evidence that hypoperfusion or insufficient tissue oxygen delivery alone may not entirely account for the cellular dysfunction observed in septic shock. Mitochondrial dysfunction and other mechanisms may also be present [28, 29].

The definition of shock emerging from this consensus conference does not require the presence of hypotension. Instead, the definition of shock as “failure to deliver and/or utilize adequate amounts of oxygen” may include, but is not limited to, the presence of hypotension.

In this conference, shock is defined as circulatory and cellular dysfunction, manifested by markers of hypoperfusion such as elevated blood lactate, decreased ScvO2 or SvO2, with or without hypotension.

In 2013, a similar conference was held, that did not change substantially the definition: Shock is best defined as a life-threatening, generalized form of acute circulatory failure associated with inadequate oxygen utilization by the cells. It is a state in which the circulation is unable to deliver sufficient oxygen to meet the demands of the tissues, resulting in cellular dysfunction. The result is cellular dysoxia, i.e. the loss of the physiological independence between oxygen delivery and oxygen consumption, associated with increased lactate levels. Some clinical symptoms suggest an impaired microcirculation, including mottled skin, acrocyanosis, slow capillary refill time and an increased central-to-toe temperature gradient.

In any case, it is now clear that patients must be closely screened and monitored for:

- routine screening of patients at risk to allow earlier identification of impending shock and
- implementation of therapy. This frequent measurement of heart rate, blood pressure, body temperature and physical examination variables (including signs of hypoperfusion, urine output and mental status) in patients with a history and with clinical findings suggestive of shock.
- the presence of arterial hypotension [defined as systolic blood pressure of 90 mmHg, or mean arterial pressure (MAP) of 65 mmHg, or a decrease of 40 mmHg from baseline], while commonly present, should not be required to define shock. Other markers should be monitored, such as plasma lactate (in a serial form), mixed venous oxygen saturation and venoarterial difference in PCO2 (VApCO2) and central venous oxygen saturation in patients with central venous access as well as other perfusion markers.
- Target blood pressure should be individualized during shock resuscitation measurement of cardiac output for patients with shock responding to the initial therapy should not be done routinely.
- Measurements of cardiac output and stroke volume should be used to evaluate the response to fluids or inotropes in patients that are not responding to initial therapy. This evaluation of the hemodynamic status should be individualized. Less invasive devices should be used, instead of more invasive devices, only when they have been validated in the context of patients with shock.
- MAP should be initially target to 65 mmHg. A lower level can be tolerated in patients with uncontrolled bleeding without severe head injury. An higher MAP may be needed in septic patients with a history of hypertension and in patients who improve with higher blood pressure.
- Arterial and CVC insertion should be done in cases of shock unresponsive to initial therapy and/or requiring vasopressor infusion.
- Therapeutic interventions to improve perfusion including hemodynamic stabilization (with fluid resuscitation and vasopressor treatment if needed) and treatment of the shock etiology.
• Inotropic agents should be added when the altered cardiac function is accompanied by a low or inadequate cardiac output and signs of tissue hypoperfusion persist after preload optimization.

• Since optimal fluid management does improve patient outcome, assess volume status and volume responsiveness. It would be best to use over static variables to predict fluid responsiveness, when applicable.

• Echocardiography can be used for the sequential evaluation of cardiac function in shock.

• Transpulmonary thermodilution or PAC should be reserved for in patients with severe shock especially in the case of associated acute respiratory distress syndrome.

• Techniques to assess regional circulation or microcirculation are recommended just for research purposes only.

Further reading


VOLUME REPLACEMENT IN THE CRITICALLY ILL - AN EVIDENCE BASED APPROACH

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Intravenous fluids are drugs that have entered the market before regulatory requirements made phase 1-3 clinical trials mandatory to prove safety and efficacy. Meta-analyses by the Cochrane Collaboration have consistently concluded that administration of colloids provide no survival benefit over use of crystalloids. There is now growing evidence that the type of fluid may directly affect patient-centered outcomes.

Hydroxyethyl starch (HES) increases the risk of death, kidney injury, and bleeding. Both the US-American and European regulatory bodies have reacted and issued restrictions. HES must no longer be given to critically ill and septic patients, and its use outside the ICU is restricted in Europe to patient groups which cannot be stabilized with crystalloids alone, do not suffer from coagulopathy, and treatment should not exceed 24 hours. The evidence on surgical patients and patients in the emergency setting is poor. The existing evidence suggests that HES leads to renal failure and increased bleeding also in surgical patients and to increased mortality in trauma patients. HES is stored in the RES of the body and leads to deposits in the kidney, spleen, liver, bone marrow and cutaneous nerves and contributes to organ dysfunction and leads to coagulation impairment.

Gelatin solutions are also synthetic colloids derived from bovine collagen. In some places, gelatin use increases to substitute for HES. Dextran is a sugar polymer. However, both gelatin and dextran have a similar risk-benefit profile as HES, with evidence for risk of increased bleeding and renal failure. There is lack of high-quality data from large-scale clinical trials to prove the safety of these i.v. fluids. Meta-Analyses from the Cochrane Collaboration have consistently shown that gelatins and dextrans have no benefit over crystalloids. Like HES, gelatins and dextrans would not be approved today and should best be avoided.

Albumin is the body's own natural colloid solution, however it has important pharmacological activity as well. Albumin is recommended in the treatment of hepato-renal syndrome and of refractory ascites and suggested in patients with septic shock sepsis when it is not possible to stabilize the patients with crystalloids. Albumin is associated with increased mortality in patients with severe traumatic brain injury and should be avoided in these patients.

Crystalloids, such as saline or balanced salt solutions, are recommended as first-line resuscitation fluids in hypovolemia. There is some suggestion that chloride-rich solutions such as saline may be associated with adverse outcomes due to the development of hyperchloremic metabolic acidosis. There is growing evidence that excessive use of fluids during the resuscitative period is associated with increased cumulative fluid balance and adverse outcomes in critically ill patients. Large-scale trials are called for.

In summary, isotonic, balanced salt solutions should be used as first-line resuscitation fluids and isotonic saline solutions can be considered in alkalotic patients. Fresh whole blood or blood components should be used in actively bleeding patients. Natural colloids should be given with care and only in selected patients if hemodynamic stabilization is not adequate with first-line fluids and vasopressors.
VASOPRESSORS IN SHOCK

Daniel de Backer

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Vasopressor agents are used to increase blood pressure in patients with circulatory shock, aiming to improve organ perfusion, and hence tissue perfusion. Adrenergic agents are mostly used for this purpose. These agents stimulate the alpha adrenergic receptor, which is responsible for the increase in vascular tone. These agents also variably stimulate beta adrenergic receptors which is associated with an increase in contractility and heart rate, and hence cardiac output, and also in splanchnic blood flow. However, beta adrenergic stimulation is also associated with increased risk of arrhythmias, immunomodulation and increased metabolism. Dopamine stimulates dopaminergic receptors which may result in doubtful effects on splanchnic and renal perfusion but may also lead to endocrine alterations. The relative stimulation of beta-adrenergic and dopaminergic receptors accounts for differences between the various alpha adrenergic agents.

Do these pharmacologic differences translate into clinical differences? In models closest to human septic shock, norepinephrine and epinephrine increased myocardial contractility and cardiac output while phenylephrine decreased it. However, epinephrine induced a significant tachycardia which resulted in a marked increase in myocardial oxygen consumption.

Clinical studies usually compare in already stabilized patients one drug to another drug or to a combination of several drugs, at doses titrated to achieve the same arterial pressure. Only a minority of the studies described the effects of drugs at their first introduction in a randomized design. Recently, several studies have evaluated the effects of dopamine, noradrenaline and adrenaline on outcome. Two middle size trials compared noradrenaline to adrenaline: these trials showed that both agents similarly restore blood pressure but that adrenaline was associated with a transient increase in heart rate and lactate levels and a decrease in arterial pH. These trials were not powered to detect differences in outcome, but there was no signal that epinephrine could be superior to norepinephrine. One large scale multicentre randomized trial compared dopamine to norepinephrine as the first agent for the treatment of shock. Dopamine was associated with a significant increase in arrhythmic events compared to norepinephrine. Although that trial failed to report in the entire population significant differences in outcome between the two drugs, there was an increased risk of death in patients with cardiogenic shock receiving dopamine. As similar results were observed in smaller size trials, a meta-analysis showed that dopamine is associated with an increased risk of death compared to norepinephrine.

Arginine vasopressin can be an interesting alternative. In a randomized trial including 800 patients addition of vasopressin to norepinephrine allowed to decrease the doses of norepinephrine. No difference in outcome were observed for the entire group, but a decreased risk of death with vasopressin was observed in the subgroups of less severe patients. These results should be confirmed but at least show that vasopressin is a safe alternative when added to norepinephrine. Whether it could be used as the first line agent is currently investigated.
IS THERE AN IDEAL MEAN ARTERIAL PRESSURE TARGET IN SEPTIC SHOCK?

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Autoregulation of the mean arterial pressure (MAP) is a key feature of the cardiovascular system. Acute decreases in MAP are counteracted by the sympathetic-mediated tachycardia, venoconstriction (which increases SV) and arterial systemic vasoconstriction. In critically ill patients, especially with sepsis or receiving sedative drugs, these compensatory mechanisms can be either impaired or overwhelmed.

The constancy of MAP in large arteries explains why MAP is considered the driving pressure for perfusion of most vital organs. As a result, when MAP falls below the lower limit of autoregulation, regional blood flow becomes linearly dependent upon MAP. In some pathological settings, and in specific vascular areas, MAP underestimates the true perfusion pressure, because of marked increases in extravascular pressure at the outflow level.

There is no universally admitted MAP threshold ensuring that blood flow is independent of arterial pressure in most vital organs. Indeed, the critical level of MAP probably differs among organs and depends on numerous factors including age, previous history of hypertension, neurovegetative state and vasoactive therapy. However, in septic shock, current resuscitation guidelines recommend to achieve and maintain MAP ≥ 65 mmHg, in order to avoid additional organ hypoperfusion [1]. This recommendation is based on the results of studies showing that increasing MAP up to 85 mmHg does not result in improved tissue oxygenation and regional perfusion [2, 3]. However, these studies did not include patients with prior hypertension who are supposed to have a rightward shift of the autoregulation curve. This should result in a higher MAP to target. Some studies investigated the effects on microcirculation of increasing doses of norepinephrine to target different MAP targets (65, 75 and 85 mmHg) in patients with septic shock [4, 5]. They showed either neutral effects [4] or improvement in microcirculation with the highest target [5]. Importantly, a highly variable response was reported confirming that an individualized evaluation is necessary for managing patients with septic shock. Recently, a multicenter randomized open-label trial was conducted to compare two MAP targets in patients with septic shock: 65-70 mmHg and 80-85 mmHg [6]. There was no difference observed between the 65-70 mmHg and the 80-85 mmHg groups in 28-day mortality rates (34.0 and 36.5%, respectively) [6]. There was no difference either in the overall rate of serious adverse events (17.8 and 19.1%, respectively) [6]. In the prospectively defined stratum of patients with chronic hypertension, those with a MAP target of 80-85 mmHg exhibited a more pronounced improvement in renal function and fewer requirements for renal replacement therapy [6]. This study thus suggests that in patients with history of chronic hypertension, targeting MAP between 80-85 mmHg is reasonable.

References
FLUID AND VASOPRESSOR THERAPY FOR SEPTIC SHOCK

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To manage sepsis, fluid resuscitation should be initiated promptly and guided by monitoring a set of dynamic or static hemodynamic variables. Fluid challenges can be repeated until cardiac output increases by more than 10% and as long as central venous pressure increases less than 3 mm Hg. Other monitoring tools may include right-heart catheterisation, transpulmonary thermodilution techniques, echocardiography, and pulse pressure or vena cava variability, according to physicians experience and current environment. Several randomized trials have investigated which type of fluids should be given in critically ill patients. Overall, trials suggested that there is no advantage from the use of synthetic colloids over crystalloids or albumin. In addition, the current evidence from randomized trials suggested that starches solution may dose dependently alter renal function and hemostasis. There is still uncertainty about differences in the benefit to risk ratio between balanced and chloride rich solutions. The current guidelines recommended the use of crystalloids as the first line fluid replacement therapy in sepsis. Albumin may be considered on top of crystalloids in the sickest patients with low albuminemia.

A systematic review found six randomized trials that compared dopamine to norepinephrine for the management of sepsis. There was evidence for significantly lower risk of dying and lower risk of life-threatening arrhythmias with norepinephrine compared to dopamine. Thus, current guidelines recommended norepinephrine to be selected as the first line vasopressor therapy in sepsis and to restrict dopamine to selected patients with low risk for arrhythmias and abnormal low heart rate. Epinephrine should be considered as a second line vasopressor therapy. Vasopressin was not shown to provide additional benefit when compared to norepinephrine. However, it may be considered for its norepinephrine sparing effects.
ADJUNCTIVE MANAGEMENT STRATEGIES FOR SEPTIC SHOCK (ANTI-INFLAMMATORY AGENTS TO STATINS)

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Sepsis with acute organ dysfunction (severe sepsis) is common, increasing in incidence, frequently fatal and expensive. In the United States, more than 750,000 cases of severe sepsis occur each year. This disease is increasing in incidence at a rate of approximately 1.5% per annum. Reported mortality rates are unacceptable in this disorder and range from 28% to 50% or greater despite the use of supportive care and appropriate antibiotics. Estimated annual healthcare costs for patients with severe sepsis exceed $16 billion, a significant component of healthcare expenditures. In the last century, an estimated $1 billion was spent on sepsis trials with more than 25,000 enrollees; unfortunately, none of the experimental interventions significantly reduced all-cause 28-day mortality. This may be a function of the complex pathophysiologic nature of this process that involves endothelial cell dysfunction and inflammatory dysfunction. The redundant nature of the inflammatory response and the timing and relationship between innate and adaptive immunity present formidable obstacles to targeting single mechanisms for sepsis therapeutics. Recent multi-center trials in adjunctive sepsis therapeutics have all failed to demonstrate a survival benefit of the investigational agent. The proposed immunomodulators have included, TLR-4 inhibitors, talactoferrin, TNF α (multiple studies), activated protein C, tissue, factor pathway inhibitor, hydrocortisone, and statins. The failure of these trials has led clinical trialists to turn to new trial design and search for new phases of sepsis to study. Adaptive design is now being tested in several studies as an attempt to refine the approach to multi-center trials. In addition, several agents targeted at enhancing the immunsuppressive phase of sepsis are in phase II trials. It is becoming clear that the more we understand about the molecular mechanisms that underlie the host response to infection, the less we know how to intervene in a beneficial manner to improve survival.
PATHOPHYSIOLOGY OF MULTI-ORGAN FAILURE

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Multiple organ failure (MOF) following major surgery, trauma and severe sepsis or septic shock remains the leading cause of death in patients admitted to intensive care units. With the significant advances in ICU care over the past 35 years, the epidemiology of MOF has evolved. Fewer patients are now dying in the early phase of MOF. However, patients who develop late onset MOF are ending up with prolonged ICU lengths of stay and higher mortality rates. The pathophysiology of MOF is thought to involve the activation and dysregulation of multiple complex overlapping physiologic systems including hormonal, cytokine, and immunologic changes. For decades, it was theorized that following a major insult such as trauma or sepsis, a systemic inflammatory response syndrome (SIRS) is triggered by various pro-inflammatory mediators (cytokines) which if robust enough would lead to early MOF and lead to death. Over time, it was observed that MOF was a bimodal phenomenon with cardiac dysfunction predominating in early MOF and hepatic failure during late MOF. Both early and late MOF had a similar higher incidence of major infections. It was also thought that the Compensatory Anti-inflammatory Response syndrome (CARS) occurs with SIRS in critically ill patients but with a distinct set of cytokines and cellular responses. More recently, as more patients in the ICU have survived the initial acute insult, many enter into the phase called chronic critical illness with ongoing organ dysfunction. A new paradigm of MOF has now emerged characterized by Persistent Inflammatory, Immunosuppressed Catabolic Syndrome or PICS. This session will discuss the latest pathophysiological concepts of multiple organ failure in the critically ill. A better understanding of the cellular and humoral alterations that occur in early and late MOF including PICS will hopefully lead to novel therapies that will improve the outcomes of these patients.
INTER-ORGAN CROSS-TALK BETWEEN BRAIN AND LUNG

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Until today, the acute respiratory distress syndrome (ARDS) is associated with a dramatically high mortality rate of 30-50 % [1]. Those patients who survive this severe entity after ICU treatment often present a years lasting, neurological decline with compromised quality of life, dysfunction of concentration and memory as well as emotional instability [2]. All these symptoms might be due to brain structural changes and lesions that were found in several studies [3].

One essential reason can be seen in a systemic inflammation after a primarily pulmonary inflammatory response in ARDS [4]. Although tailoring tidal volume to the patient’s ideal body weight and limiting plateau pressures as an evident concept of lung protective strategies, current studies demonstrate that ventilator induced lung injury (VILI) could still occur and thus promote systemic inflammation leading to damage of peripheral organs, including the brain.

Beside the possible negative effects of mechanical ventilation on local pulmonary inflammatory mediators in the bloodstream with activation of a cerebral response, another explanation for neurological decline can be seen in an altered regional cerebral perfusion and in brain oxygenation due to increased airway pressures. In this context, Bickenbach et al. found the application of mechanical ventilation with low tidal volumes in terms of lung protection to result in improved brain tissue oxygenation and metabolism in a porcine model of acute lung injury [5, 6].

In conclusion, recent data from experimental and clinical studies have demonstrated increased evidence of a cross-talk between the lung and the brain in ARDS, especially when VILI and thus a distinctive systemic inflammation occur. Conversely, a reduction in VILI might reduce brain injury. Mechanisms or pathways conducting the crosstalk are not completely understood it is known that several inflammatory mediators released from lung tissue (e.g., interleukin-6 (IL-6),tumor necrosis factor α (TNFα) and IL-1β) may directly reach the brain. Further study need to explicitly focus on these mechanisms.

NEUROLOGIC COMPLICATIONS OF SHOCK

Romer Geocadin

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Shock syndromes lead to critical reduction in blood flow to vital organs. The nervous system is very sensitive to blood flow and oxygenation changes. In normal states, the brain is able to maintain adequate blood flow by its intrinsic property of autoregulation. But in shock states the autoregulatory process is impaired making the nervous system very susceptible to injury. Shock states may impact the brain in at least two ways: 1) global ischemia leading to the specific brain injury patterns and 2) direct injury to the nervous system that is primarily related to the etiology of the shock syndrome. Global brain ischemia may result from cardiac failure (i.e. cardiac arrest; arrhythmia), loss of vascular tone (i.e. sepsis; spinal cord injury) or loss of vascular volume (i.e. hemorrhage, dehydration). There are two general patterns of brain injury secondary to abrupt reduction in blood flow: 1) selective vulnerability and 2) watershed infarctions.

Selective vulnerability is typical noted in regions of the brain such as the cerebral cortex (especially cortical neurons), basal ganglia, thalamus and the cerebellar Purkinje cells. Clinically acute dysfunction of the cerebral cortex is manifested as encephalopathy or delirium. As injury progresses, the patient becomes drowsy and loses consciousness as the subcortical structures such as the thalamus and the brainstem are affected. Coma is one of the most common clinical manifestations. Injury and irritation of the cerebral cortex may also result in seizures. Protracted cortical injury from long term low blood flow states may result in a wide range of cognitive dysfunction in survivors.

Brain watershed infarctions result from injury to areas between terminal blood vessels, such 1) the area between the anterior cerebral artery [ACA], the middle cerebral artery [MCA], 2) the area between the posterior cerebral artery [PCA] and MCA) and 3) the area between the ACA and the MCA. The spinal cord is also susceptible to watershed infarction, commonly noted at the T10 level (artery of Adamkiewicz). Clinically these conditions present may present as weakness in areas affected, such as bilateral arm weakness (with ACA and MCA watershed) and bilateral leg weakness (with spinal cord watershed). Specific injury to the nervous tissues can also be caused by the etiology of shock, such as the brain injury related to infective agents, toxins and the inappropriate inflammatory response.

Early recognition is important in the prevention and management of injury. At this time the most important means of detecting shock related brain dysfunction is still the neurologic exam. However, this is widely confounded by the drugs especially sedation and associated systemic derangements. Neuroimaging by CT scan may not show the early signs of infarctions. MRI may show early signs of brain injury but the severity/complexity of these patients limit MRI testing during the most critical times. Neuro-electrophysiology, especially EEG may detect seizures and lead to treatment, and may also assist in prognostication. Other diagnostic tools may include technologies that measure blood flow, brain oxygenation and brain metabolism. Most of these approaches are still under investigation.

The management of neurologic injury secondary to shock syndromes needs to focus primarily on the correction of low blood flow states. Systemic resuscitation must be undertaken to allow the brain to maintain its cerebrovascular autoregulatory property. Management of the primary etiology of shock is also important in controlling subsequent neurologic injury (i.e. infection, intoxication, etc). Secondary brain injury must be recognized early and managed (cerebral edema, elevated intracranial pressure, seizures, etc). Neurologic testing may also be undertaken to help in the prognostication of patients.
LUNG-KIDNEY INJURY CROSS-TALK

Mary Choi

Weill Cornell Medical College, United States

Acute kidney injury (AKI) is a frequent complication in critically ill patients, particularly those with sepsis, and is associated with increased mortality. Despite advances in renal replacement therapy and supportive care, the morbidity and mortality associated with AKI in the critically ill remain high. Moreover, pre-existing chronic kidney disease (CKD) has marked impact on occurrence of AKI. Kidney dysfunction can also adversely affect distant organ function including the lungs. It is now recognized that AKI-induced acute lung injury (ALI) extends beyond simple volume overload. Emerging body of evidence suggests that the deleterious kidney-lung crosstalk in AKI occurs via soluble and cellular mediators. Induction of cytokines, enhanced inflammatory responses, and neutrophil activation have been demonstrated in animal models of kidney injury induced by renal ischemia-reperfusion and bilateral nephrectomy. We have additionally shown that CD11b+Ly6G+neutrophils were increased not only in the kidneys, but also in the blood and the lungs following kidney injury induced by unilateral ureteral obstruction (UUO). Thus, AKI can lead to multiple organ dysfunction through increase in circulating cytokines as well as activated leukocytes, resulting in the infiltration of cells into distant organ systems, including the lungs and cause ALI.

Given that AKI can play a central role in the development of multiple organ failure, it is imperative for new therapeutic strategies that protect against AKI in order to improve the outcomes of critically ill patients. Understanding the mechanisms involved in the pathogenesis of kidney injury is crucial in developing new therapeutic targets. Our investigations have centered on the pathophysiological role of a pleiotropic cytokine Transforming Growth Factor-beta1 (TGF-β1) as critical mediator of kidney injury, and the mechanisms of downstream intracellular signal transducing pathways that mediate TGF-β1 signals. While TGF-β1 is one of the most potent pro-fibrotic cytokine, our work supports a provocative paradigm that TGF-β1 can exert paradoxical cytoprotective effects.

Currently, our research has focused on the role of autophagy and mechanisms of cytoprotection in the kidney. Autophagy is an evolutionarily conserved process that cells use to degrade and recycle cellular proteins and remove damaged organelles. During the past decade, there has been a growing interest in defining the basic cellular mechanism of autophagy and its roles in health and disease. We uncovered that autophagy contributed to renal cell survival, by using both pharmacologic and genetic blockade of the autophagic pathway, via autophagic protein LC3 gene deletion (LC3-/−) or LC3 siRNA. We also showed that TGF-β1 induced autophagy, via TAK1 and PI3K-Akt dependent pathway. In mice deficient in autophagic protein Beclin 1 (beclin 1+/−), we demonstrate that autophagy negatively regulates matrix production by promoting intracellular degradation of collagen and aggregated insoluble procollagen. In UUO model of kidney injury, we demonstrated that autophagy regulates TGF-β1 expression and activation of autophagy promotes degradation of mature TGF-β, and thereby decreasing TGF-β secretion, and suppresses renal tubulointerstitial fibrosis. Our findings provide support for the cytoprotective role of autophagy in the kidney, and hold promise of a new therapeutic target against kidney injury and hopefully mitigate distal organ damage like lungs.
MODELS FOR CRITICAL CARE DELIVERY

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University of Washington Medical Center, United States

The goal of critical care is to optimize care of acutely ill patients to reduce mortality and morbidity as well as to produce the quality of life appropriate to the patients needs. Successful achievement of these goals depends on applying core principles to care provision both within and without the ICU. This presentation will address the key elements to applying effective care across the continuum from pre-hospital, through the emergency department, operating room, ICU, regular floor, rehabilitation, long-term care facilities and home.

The key components of an ICU are human capacity, infrastructure, policies and guidelines and institutional culture. It is evident that outcome is significantly affected by care provided before and after ICU such that models must recognize the importance of applying ICU principles in these domains. Differences between models for care in high and low resource settings will also be addressed. The ability to provide care must be tailored to the resource environment in a way that is respectful, non-judgmental and consistent with the policies, attitudes and behavior of each environment.

At the end of the presentation attendees will be able to understand the following:
1. Core elements of an effective ICU
2. Integration of health care services across the spectrum of care
3. Application of ICU principles to other levels of a health care system
4. Recognize the differences in care provision between high and low resource settings.
IT’S TIME FOR GLOBAL ICU ACCREDITATION!

Khalid Shukri
International Pan Arab Critical Care Medicine Society, Saudi Arabia

ICUs around the world have variation levels of care, designs, practice, training, systems. In view of literature there are 3-4 levels of care from SCCM and ESICM. There is a need to re-evaluate the ICU standards globally, we approach an international project titled ARGUS which is initiated by well known figures in critical care world wide.

We divided the levels of care to 7 levels with 12 standards with a scoring system, this scientific approach will make facilitate; ICU Accreditation, Mapping of which levels of care available in your area plus the feasibility to upgrade the ICU to next levels for best practice.

In summary: we look forward for an international consensus group to start the blueprint framework for this extraordinary global project which will benefit the field of critical care and healthcare in years and generations to come.
INTEGRATING NURSE PRACTITIONERS AND PHYSICIAN ASSISTANTS IN THE MULTI-PROFESSIONAL ICU TEAM

Jean-Louis Vincent

Erasme Hospital, Université Libre de Bruxelles, Belgium

Nurse practitioners and physician assistants have been used in critical care medicine for many years, particularly in the USA, and with increasing demand for intensive care and a shortage of intensivists, may represent a vital addition to the ICU team by performing certain roles currently reserved for physicians. In a recent study, 72% of the American ICUs included reported that nurse practitioners and physician assistants participated directly in patient care. Importantly, the role of nurse practitioners and physician assistants is not to replace or compete with the physician, but to facilitate the physicians job by taking on some of his/her tasks. Nurse practitioners and physician assistants can be involved in initial patient assessment, history taking and physical examination; ordering of appropriate tests and initiating treatments, especially when protocol-based; setting up of non-invasive monitoring systems and recording measurements when intermittent; promoting communication with patients and family members. Some may also be able to perform or assist with certain invasive procedures (e.g., suturing, central and arterial line placement) or even minor surgery. Employing nurse practitioners and physician assistants can impact positively on patient care and reduce physician hours, without altering patient outcomes or costs. Nurse practitioners and physician assistants should be seen as having roles that complement those of the physician and other members of the ICU team, including nurses, physiotherapists, clinical pharmacists, etc. To optimize patient care, these multiple disciplines must work together as a unified, coordinated team with all members must be encouraged to actively participate in patient rounds and ongoing educational activities, thus fostering good collaboration and communication.
REPORT OF THE TASK FORCE OF THE WFSICCM:
WHAT IS AN ICU

John Marshall

University of Toronto, St. Michael’s Hospital, Canada
**ICUS WITH BETTER OUTCOMES: HOW DO YOU DO IT?**

**Edgar Celis-Rodriguez**  
*University Hospital Fundacion Santa Fe de Bogota, Colombia*

Intensive care units (ICUs) are complex organizations where the critically ill patients have become very complex due to the severity of illness, the increased number of patients requiring intensive care, the clinical information available is growing and has a dramatic impact on patient outcomes and on the hospitals financial and operation success. Currently, ICUs account for approximately 10% of the beds in a hospital, and they degenerate 30% of a hospital’s cost. There is a great pressure for the hospitals to improve the performance of their ICUs. It has become problematic for clinicians to master all of these tasks and to process the quantity of available clinical and scientific information in an effective and safe manner.

To accomplish this goal, as well as to allow more medical practices, it is necessary to develop several strategies as protocols or guidelines and adopt specific metric indicators at a departmental level. Protocols and specific indicators appear to be a useful tool for improving processes of medical care and patients outcomes.

The ICU of the Fundacion Santa Fe de Bogota University Hospital since several years ago has developed protocols and quality indicators that show the clinical practice as standardized processes to improve patient outcomes. The guidelines adherence has an impact on improving clinical performance (lower ICU mortality rates, length of stay, VAP, catheter infections, APACHE II score).

**METRIC INDICATORS**

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**BIBLIOGRAPHY**


TRIAGE OF ADMISSIONS TO INTENSIVE CARE

Charles Gomersall

The Chinese University of Hong Kong, Hong Kong
CHANGING ICU CULTURE TOWARDS A SAFETY ENVIRONMENT: STAFF AND FAMILY ROLE

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ICU directive board involvement is a necessary condition for achieving a change towards a patient care safety culture. This condition is necessary but not enough. For a safety program to be successful it is essential that the whole institution be clearly engaged in a global hospital quality improvement and patient safety program.

The main strategy goal is to change from an institutional centred medical care to a patient centred health care scope. This is not an easy change because we have not educated in this approach.

Changing to a patient safety culture implies the participation of the ICU staff members in improvement groups. These groups must be made up of each professional, technician or administrative tasks levels working in the ICU. Their tasks must be to develop a Plan Do Study Act (PDCA) cycle.

The cycle must be directed to:

Plan: To establish the objectives and processes necessary to deliver results in accordance with the expected output.

Do: To implement improvement in process reporting the whole organization in the new approach.

Check: To compare actual results with expected ones.

Act: To decide to proceed if results indicate an improvement in patient safety, educating staff members in the new tasks. If not return to PLAN step.

Important steps in the patient safety program are measuring through appropriate surveys the ICU staff safety perception and training them in the international safety goals proposed by national and international health agencies. Main goals in training are: to identify patients correctly, to promote effective communication, to improve medication safety, to promote a safety surgery, to decrease risk of patient fall and to reduce risk of healthcare related infection.

Nevertheless there are many factors that disturb the path to an ICU safety culture. Mainly doctors and nurses are under a lot of pressure in their daily tasks with frequently interruption of the workflow that induce to commit errors, to increase fatigue and eventually to reach in predisposed personalities to a burn out condition. All of these factors that continuously perturb the workflow deserve to be considered like noises in the communication process. These noises may be classified into:

1. Environmental noise.
2. Too frequent equipment alarms.
3. Interruption in the workflow.
4. Task overload.
Strategies to avoid these noises must be developed:

1. To protect nurses in the medication process
2. To avoid team workflow interruptions redesigning care process.
3. To train healthcare team in skills of communicating with patient and family.

Only when the health care team is imbued with a patient centred safety care culture a further step to educating patients and families in the aim of self-care control will be able to be successful. Family participation may help in rapid rehabilitation of the critically ill patient. It is an important target to achieve because of the increasing number of chronically ill patients with long periods of mechanical ventilation. To get them out of bed as soon as possible and also make them to walk early may be helped by patient and family.
THE KEYS TO SUCCESSFUL ROUNDS

Craig Coopersmith

Emory University School of Medicine, United States

Although the concept of rounding in the ICU is relatively universal, the content of rounds varies widely between different institutions and different countries. Although there is no single correct way to round, there are common themes about how to make rounds effective that transcend where one practices. There are many stakeholders that are impacted by rounds, including all members of the multidisciplinary ICU team and the patient and their family. At a minimum, rounds must ensure effective communication of the daily plan such that all stakeholders understand the goals for the day, the interventions and changes required to attain these goals, and the metrics that will be assessed to determine the utility of each intervention and change. In a teaching hospital, rounds must also balance the need for trainee education with the need for efficiency. This lecture will go over practical lessons to make rounds successful, regardless of the environment one practices in.
WORDS MATTER - ON EUTHANASIA, TERMINATION OF TREATMENT, AND OTHERS

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Background/Purpose (introduction)
Despite the improved odds of survival of patients in modern intensive care units (ICUs), still a considerable number of patients cared for there will die from their dire conditions. It is especially in such end-of-life scenarios that the communication skills of the health care team do not match the technical treatment tools at their hands. Apparently, many physicians have not developed or maintained their professional skills regarding a wise and careful use of language as the most communicative part of their care (1-3).

Methods
Three terms frequently used in publications or in conversations between the health care team and the patients/families are revisited exemplarily.

Results
Allow natural death. This term is meant to replace the widely used do-not-resuscitate code (4), yet it portrays death in an ICU to be natural. There are probably several visions in modern populations as to what would constitute a natural death, but given the fact that the majority of citizens still want to die at home, death in an ICU is distinctly not natural for most patients there.

Termination of therapy. This term is equivocal because it might convey to the patients and their families that the health care team will stop caring for them (1, 2). In fact, the care for the patient will be continued unequivocally, even though life-sustaining therapies might be terminated as the status of the patient deteriorates.

Euthanasia. In ancient history, this term meant the facilitation of a good death (greek, εθανασια). Its continuous use with several different connotations even in the 21st century epitomizes a certain naivete, if not ineptitude, to rectify terms (2, 5). In some modern societies, euthanasia stands for the active shortening of the dying process, concerning, amongst others, incapacitated patients in ICUs. In some countries, such as the Netherlands and Belgium, euthanasia is a legally accepted form of ending the life of a competent patient at his/her repeatedly stated informed desire, and therefore practically not feasible in ICUs. Whereas in some other countries this practice is strictly forbidden by criminal and statutory law (e.g. in Germany), in others it is legally tolerated and capitalized (e.g. in Switzerland), resulting in downright euthanasia tourism. In European history, finally, euthanasia was a euphemism for the murder of innocent and mostly handicapped citizens under the Nazi-German tyranny (5). Therefore, rather than prolonging an untoward mishmash, the term euthanasia should not be used for medical procedures at all (unless stipulated by law).
Conclusions

The skilled use of proper language and adequate terminology needs to be thoroughly revived in order to meet one of the most important challenges of modern intensive care medicine.

Literature


Keywords: Importance of language, Communication, Euthanasia
**HOW DIFFERENT WE ARE?**

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End-of-life (EOL) care is the care to be performed for terminally ill patients when death is imminent. EOL care frequently includes decisions on withholding and/or withdrawal (WH/WD) a life-sustaining therapy (LST). WH of LST commonly has been performed in Asian intensive care units (ICUs). In a recently conducted intensive care physicians perception of EOL care in 466 ICUs of 16 Asian countries/regions, for patients with no real chance of recovering a meaningful life, 70.2% intensivists of the respondents reported almost always or often withholding LST(1). But these proportions varied widely among Asian ICUs. In a hypothetical setting of hypoxic-ischemic encephalopathy, the corresponding range to implement DNR order was 48.4% to 100% among the respondents.

Multiple factors related to country or region, including economic, cultural, religious, and legal differences, as well as personal attitudes, were associated with different EOL care level in Asian ICUs. In addition to patients and their families suffering, the financial burden related with EOL care is frequent issue in most of Asian ICUs. And, familial input is strongly influential in Asian countries. Conflict between caregivers and family members over the level and nature of EOL care is often apparent when financial burden is underlined. Legal concern related to the WH/WD of LST is also not well addressed in most Asian countries. Fair resource allocation under limited medical resources is another hidden big issue of EOL care in Asia.

It is not usual and easy to discuss EOL care with critically ill patients in advance in Asian ICUs. The advance directive or POLST (physician orders for LST) is not a prevalent way to perform the EOL care in Asia. Patients and their families do not like to discuss about death in the early stages of intensive care. Hospital ethic committees do not seem to function well to cope with encountered EOL care issues at patients bedside in most Asian countries. Under these barriers of EOL care decision making, patient beneficence and autonomy may not have been carefully considered. In fact, discussions regarding patient preferences for resuscitation could be often delayed and preferences may be neglected, leading to the receipt of unwanted medical care. To overcome these barriers, attending physicians role to guide EOL care is really significant, because either futile or overly burdensome is not a patients best interests.

IS WORLDWIDE CONSENSUS ON END-OF-LIFE CARE ATTAINABLE?

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There are great differences in end-of-life medical practices around the world. Practices vary based on many factors, including geography, religion, culture, religiosity and patient, physician and institutional characteristics. The WELPICUS (Consensus for Worldwide End-of-Life Practice for Patients in ICUs) study sought to develop worldwide professional consensus for key end-of-life practices. It was believed that despite different opinions, cultures, religion, regions and training and background for health care professionals, there is a consensus for most end-of-life practices. Critical care societies worldwide were invited to participate. Country coordinators were identified and draft statements were developed for major end-of-life issues and translated into six languages. Multidisciplinary responses using a web-based survey assessed agreement or disagreement with definitions and statements linked to anonymous demographic information. Consensus was prospectively defined as > 80% agreement. Definitions and statements not obtaining consensus were revised based on comments of respondents, and then translated and redistributed. Of the initial 1,283 responses from 32 countries, consensus was found for 66 (81%) of the 81 definitions and statements; 26 (32%) had > 90% agreement. With 83 additional responses to the original questionnaire (1,366 total) and 604 responses to the revised statements, consensus could be obtained for another 11 of the 15 statements. Consensus was obtained for informed consent, permissibility of withholding and withdrawing life-sustaining treatment, legal requirements, intensive care unit therapies, cardiopulmonary resuscitation, shared decision making, medical and nursing consensus, brain death, and palliative care. Consensus was obtained for 77 of 81 (95%) statements. Consensus could not be obtained for 4 statements related to obtaining agreement for withholding and withdrawing life-sustaining treatment, permissibility of active shortening of the dying process and procedures for families who do not accept brain death. Worldwide consensus could be developed for the majority of definitions and statements about end-of-life practices. Statements achieving consensus provide standards of practice for end-of-life care; statements without consensus identify important areas for future research.

Reference

REPORT OF THE TASK FORCE OF THE WFSICCM: END-OF-LIFE CARE

John Myburgh

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PATERNALISM: PATIENTS, PHYSICIANS AND JUDGES AS DECISION-MAKERS

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This discussion will focus on the changing relationship between the patient and family members, primary care physicians, specialist physicians, critical care team physicians and allied health professionals, members of the clergy and other caregivers that influences management decisions at all intersections in the care pathway from diagnosis to discharge.

The most emotionally charged area in this sequence is decisions involved in critical situations in which the patient’s wishes must be interpreted, in many instances complicated by an uncertain medical future in a complex clinical reality. Decisions are temporal and, while the proximate strategy is relevant, important longer term considerations are often obfuscated by the immediacy of the moment; ultimately, this may lead to a series of similarly rushed decisions that force an undesirable long term clinical course that leads to an untenable ethical situation requiring intervention from a variety of sources; ethics committees; other physicians; religious partners; and the courts.

A Google search on paternalism creates a number of definitions (67,200):
1. the policy or practice on the part of people in positions of authority of restricting the freedom and responsibilities of those subordinate to them in the subordinates supposed best interest (Wikipedia)
2. the interference of a state or an individual with another person, against their will, and defended or motivated by a claim that the person interfered with will be better off or protected from harm (Stanford Encyclopedia of Philosophy)
3. the attitude or actions of a person, organization, etc., that protects people and gives them what they need but does not give them any responsibility or freedom of choice (Merriam Webster)
4. the system, principle, or practice of managing or governing individuals, businesses, nations, etc., in the manner of a father dealing benevolently and often intrusively with his children (Dictionary.com)

In all instances choice is restricted, the actions are perceived to be in the individuals (person whose self-determination is restricted) best interests and in only one is the action linked to that of a parent. Perhaps more important to our discussion is an understanding of the concept of free will as defined in Wikipedia: Free will is the ability of agents to make choices unimpeded.

In medicine the concept of free will is constrained frequently by limitations imposed directly by the disease state or indirectly by its therapeutic requirements. In this setting the roles of physician and caregiver, patient, relatives and potentially legal guardians intersect and sometimes conflict depending upon the jurisdictional culture and setting in which the interaction takes place. Religious and cultural overtones cannot be ignored, and in today’s multinational society, the prevalent cultural norm may be at odds with that of the patient and family. It is interesting to consider at what level compromise is appropriate and it is in this sense that a paternalistic attitude or posture can have significant impact.

The panel will explore the varying nature of and impact of the physicians role in these often culturally complex and in all cases emotionally challenging circumstances that affect all participants equally.
“FAMILISM”: FAMILIES AS DECISION-MAKERS

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Familism as defined by Merriam-Webster Dictionary is a social pattern in which the family assumes a position of ascendance over individual interests.

In healthcare, the doctor-patient relationship shifted from paternalistic to autonomy model in the 1970s to shared decision model in the 1990s. In the shared decision model, patients or families and physicians work together as partners to make healthcare decisions.

In the intensive care unit, as most patients cannot communicate, the doctor-patient relationship is largely replaced by intercommunication between the entire medical staff and patients families unless there exist an Advanced Care Directives by the patient or a surrogate - Surrogate is defined as an individual, other than a patients agent or guardian, authorized to make a health care decision for the patient.

There are considerable challenges involving the family in the decision-making process. A lot of patients choose not to discuss their wishes with their family. Some family members may find it difficult to shift their frame of mind from what they want to what they believe the patient wants, consciously or subconsciously make decisions without a clear understanding of the real situation or with reference to information provided on the Internet or make decisions in their own best interests rather than the patients.

In addition, families may find it a substantial burden to share in medical decisions. In a study by Azoulay et al on risk of post-traumatic stress symptoms in family members of intensive care unit patients, the authors found that in families of patients involved in end-of-life decision, the risk of post-traumatic stress symptoms was increased 3 months after the death.

Therefore, it is essential that ICU workers pay attention to the well-being of families who invariably become involved in shared decision making when there exists neither Advanced Care Directives nor Surrogate. The ten key points recommended by Azoulay et al in their review published in Annals of Intensive Care 2014 to improve family care in the ICU are good practice to be implemented.

The ten key points are:
The nurse-physician liaison pair
Regular debriefing meetings attended by both physicians and nurses
Sharing decisions between physicians and nurses (decision-making meetings)
Moving from information to communication
Opening the ICU visiting hours
Informal and brief conversation with the family at ICU admission
Formal meeting on the third ICU day
The end-of-life conference
The ICU discharge visit

Evaluating information and communication practices and teaching communication skills to healthcare workers

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ADVANCE DIRECTIVES: AN EFFECTIVE TOOL IN ICU?

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As noted, in the United States, advance directives are formal or informal instructions to healthcare providers, family members, or others involved in a patient's care regarding treatment that may be required while the patient is unable to participate in medical decision making. The earliest form of advance directive was the "living will." Classically, the living will is restricted in terms of both scope and applicability. Living wills are usually reserved for patients with terminal illnesses and are typically restricted to statements about forgoing medical treatments that would "only prolong my dying"; they typically make explicit statements about the acceptability of discontinuing intravenous fluids and artificial nutrition if death is imminent and there is no significant hope for recovery. They usually do not provide instructions in case of nonterminal illness and typically do not name a surrogate. A more generally useful legal document is one that gives statutory authority to an individual to make medical decisions for a patient in case of incapacity. This document is sometimes referred to as a durable power of attorney for health care. Similar to a durable power of attorney that provides legal decision-making authority for financial and other matters in case of incapacity, this document provides legal standing to a named surrogate with regard to healthcare decisions. These documents typically provide an opportunity for an individual to give general information about healthcare preferences in a variety of situations. Some also provide an opportunity for the person to make a statement about quality of life and the kind of life that would and would not be worth living. Preferences for organ donation, wishes for spiritual care, and even funeral arrangements are sometimes included.

Additionally, a number of advisory documents have been developed, including "values histories" and the medical directive developed by Linda and Ezekiel Emanuel.1 These documents may present a series of increasingly dire scenarios and ask about overall preferences ("do everything possible to prolong life," "continue aggressive care but reevaluate often," "keep me comfortable, but do not provide care that prolongs my life"), or they may ask more general questions about what makes the person's life "worth living." It is hoped that this information will be helpful to a surrogate who must decide whether to continue supportive care in the case of irreversible injury or damage or even to continue disease-oriented care in the case of critical illness and impaired decision-making capacity.

For a variety of reasons, advance directives have not achieved wide popularity. When they exist, they are often not specific enough to provide meaningful guidance.2 Even when a detailed directive exists, a question often remains about whether the individual was adequately informed. For example, a patient's advance directive says that she would never want to be on "life support," but when she is asked about mechanical ventilation in the case of reversible respiratory failure from pneumonia, she says of course she would want that. Thus, following a legally executed advance directive without verifying what was meant by the patient and whether the written wishes apply to the current illness is often quite problematic. It could in fact result in a preventable death in a patient who, with proper education, would wish to be treated.

A more limited form of advance directive, known as a code status, is sometimes sought on admission to the hospital, and especially on admission to the ICU. A code status is an advance directive that is specifically lim-
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...ted to a patient’s (or surrogate’s) preferences regarding cardiopulmonary resuscitation (CPR) and other measures in the event of cardiopulmonary arrest. In many hospitals and other healthcare institutions, as a matter of policy, any patient who suffers cardiac arrest is treated with interventions designed to attempt to reverse the life-threatening derangement, including CPR, electrical defibrillation, and intubation and mechanical ventilatory support. Because a patient who suffers a cardiopulmonary arrest will die in a very short time without interventions, the discussion about code status is as much about how a patient wishes to die as it is about whether he or she wishes to live. Tomlinson and Brody distinguish three distinct rationales for a do-not-resuscitate (DNR) status: (1) CPR has such a low likelihood of producing the desired outcome that it is effectively “futile,” (2) there would be an unacceptable quality of life after CPR, and (3) there is already an unacceptable quality of life, and cardiopulmonary arrest would be a welcome deliverance. A decision about CPR may not give much useful information about a patient’s preferences regarding other aspects of his or her illness. A patient may choose aggressive disease-oriented measures well into a severe illness but still choose to forgo resuscitation in the event of an arrest. This approach may be voiced in a statement such as, “I want to fight this thing with all I have, but when it is my time, I want to go quickly without suffering.” Such a statement would be an opportunity to address resuscitation status, in addition to addressing overall goals of care (see later).

Many ICU patients who are actively receiving intensive disease-oriented care have a DNR code status. Such a directive may save surrogates and family members from the emotionally difficult task of removing life-supporting care. A patient’s acceptance of DNR status may signify acceptance of the limits of medical science; refusal of DNR status in the setting of progressive irreversible illness may be an indication that the patient has an incomplete and perhaps unrealistic understanding of the illness. Further discussion, addressing knowledge deficits or unspoken fears, may increase the likelihood that the patient’s true wishes will be followed.

A common error when discussing code status is the failure to address post-resuscitation issues. Patients who undergo CPR will most likely be incapacitated for at least a period of time after the resuscitation, even in the best scenarios. There is also a significant risk of permanent brain injury after cardiopulmonary arrest and resuscitation. Thus, it would be prudent for the patient to name a preferred surrogate as well.

Any discussion of advance directives should attempt to answer at least three questions: (1) In the event of cardiac arrest, do you want the healthcare team to attempt resuscitation? (2) If you become incapacitated, who do you want to make decisions for you? (3) If you were left significantly impaired after an attempt at resuscitation, would you want us to discontinue life-sustaining care? Preferences for resuscitation are best understood in the context of an individual’s values, beliefs, relationships, and culture.

Many problematic end-of-life issues can be traced to a focus on interventions (“Would you wish to be intubated?”) without an adequate exploration of values (“What do you value about your life? What are the things that make your life worth living?”). It is also a mistake to think about advance directives as an issue limited to end-of-life situations. Advance directives are really just part of informed consent for any treatment, and discussion of advance directives is an important aspect of good medical care.

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WEIGHTING ADVANCE DIRECTIVES: ARE LAWS HELPFUL?

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Background/Purpose (introduction)
Statistically, a substantial number of patients cared for in intensive care units (ICUs) will die from their illnesses or injuries, and many of those die ensuing the limitation of life-sustaining therapies. However, most of the patients in ICUs are no longer capable to make autonomous decisions on their end-of-life care (1) - decisions which are probably amongst the most difficult to take both for oneself (as a patient) and for others (as part of the health care team). Therefore, advance directives (ADs) have been portrayed as a promising means for all citizens to express their wishes regarding the extent of treatment in the future, when they have become incapacitated (2, 3). In the meantime, several countries or states have passed laws regarding ADs, for instance the United States, the United Kingdom, the Netherlands, France, Austria, Germany, Switzerland, and South Australia. Their relevance for clinical treatment decisions, however, appears still questionable.

Methods
Laws concerning ADs for several countries or regions and their implementation into clinical practice were reviewed.

Results
Despite their being based primarily on the commonly acknowledged principle of every citizen’s right to autonomy, the legal stipulations regarding ADs show a wide variation amongst countries and regions. In some, ADs are binding prima facie for health care providers - albeit frequently certain formal or content-related requirements need to be met. In other legislations, however, ADs are merely persuasive. Overall, there is no unanimity as to what minimal formal requirements ADs need to fulfill and what reasonable grounds should be set forth for health care providers to not follow them.

Even within a given legislation, binding ADs may be widely overruled by clinicians. In one prominent example, therapies clearly asked not to be implemented by means of ADs were frequently still executed (4). This may cause substantial hardship for the patients and their families as well as conflicts between them and the treating team.

Conclusions
It appears far from clear that ADs are a general means for resolving all end-of-life conflicts presented by incompetent patients. The given clinical circumstances at any point of disease processes may be very complex and are often not foreseeable for the majority of citizens who formulate ADs while still competent to do so. Therefore, most ADs leave room for interpretation or clarification: a task for the health care team to fulfill in each individual case, not for the legislators to solve beforehand for all possible scenarios.
In short then, laws regarding ADs are helpful to enforce the general right to determine the extent of treatment towards the end of life. However, laws cannot substitute for clinical and ethical reasoning in end-of-life situations, nor for the lack of preparedness amongst the health care team to act accordingly.

**Literature**


**Keywords:** Advance directives, End-of-life care
Emergency Neurological Life Support (ENLS) is a new educational program from the Neurocritical Care Society (NCS) which is focused on the golden hour of resuscitation for neurological emergencies. Analogous to Advanced Cardiac Life Support (ACLS), ENLS emphasizes focused assessment and treatments and the use of standardized checklists and communication so that providers can collaborate more effectively. ENLS is comprised of 13 different protocols. ENLS for intracerebral hemorrhage (ICH) centers around early and rapid diagnosis and attention to 4 main issues in the hyperacute setting: classification using clinical and neuroimaging criteria, correction of coagulopathy, blood pressure control, and decision-making regarding the need for urgent surgery. This talk will describe the overall ENLS program and center on ENLS for ICH, including case examples of how this approach can be applied in specific patients.
ISCHEMIC STROKE

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Ischemic stroke is an important complication that can occur in the critical care unit. Stroke in the setting of a critically ill patient can be a devastating complication. The standardization of ischemic stroke management has been an important development for improving outcomes. First, the advent of intravenous TPA for the treatment of ischemic stroke helped to standardize acute treatment. The treatment protocol for the NINDS trial became the acute stroke treatment algorithm. Recent advances in intra-arterial treatment for large vessel ischemic strokes have demonstrated improved outcomes. This only emphasizes the further need for standardized care. Emergency Neurological Life Support (ENLS) has been developed to help standardize the care for patients with acute neurologic disease. In this session I will discuss the basics of the ENLS ischemic stroke treatment algorithm. I will discuss the epidemiology of ischemic stroke in the critical care population. The focus of the session will be around the work-up and management of the critically ill patient with ischemic stroke.
NON-CONVULSIVE SEIZURES: SHOULD IT BE AGGRESSIVELY TREATED?

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Non-Convulsive seizure (NCS) is defined as a seizure that have electrical ictal discharges in association with only subtle or no clinical phenomena in a patient with impaired consciousness. Non-convulsive status epilepticus (NCSE) indicates a condition of ongoing NCS for longer than 30 minutes or intermittent NCS without recovery of consciousness in between attacks. The incidence of NCSE is about 20/100,000/year and 3 to 10 times higher in elderly patients. Previously NCSE was divided into absence SE and complex partial SE, however, EEG investigations in patients suffering from acute brain insults or manifesting altered consciousness without any obvious reasons in the ICU-setting have revealed electrical ictal discharges in 10%-40% of them, which was more frequently reported in studies using continous EEG (cEEG) recordings. These patient groups are often called as NCSE in Coma, which has attracted continuing controversies and debates in their diagnosis and optimal management.

The pharmacological management of NCSE usually follows the treatment guideline of convulsive SE consisting of initial administration of iv-Lorazepam (LZP) or im-Midazolam (MDZ), and following intravenous administration of second-line AEDs, most frequently iv-Phenytoin (PHT) or phos-PHT. If seizures continue, most experts recommend to try third-line AEDs, which are continuous intravenous infusion (cIV) of anesthetic drugs, pentobarbital (PTB), propofol (PRF) or MDZ. However, the use of cIV-anesthetic drugs in the management of NCSE has been criticized for lack of benefit and its frequent associations with complications, prolonged duration of drug-induced coma and mechanical ventilation, higher incidence of infections, and hypotension requiring vasopressor drugs, which were proposed as significant risk factors for higher mortality. In addition, recent introduction of various second-line AEDs (iv-valproate, levetiracetam, and lacosamide) as well as renewed interests for the use of ketamine attracted interests for trying more non-sedating drugs prior to the use of cIV-anesthetic drugs. It is still unclear whether NCSE causes permanent neurological damages, which was different from cases of convulsive SE. Most hospital cohort studies showed that etiology, severity of SE at presentation (STESS), and medical comorbidities were major independent factors for the outcome, while the impact of early control of NCSE on prognosis has not been demonstrated yet. However, potential synergistic interactions between NCSE and acute brain insults for worse outcome have been suggested, thus raised a concern for higher penalty of delayed control of NCSE by prolonged trials of non-aggressive treatment.

In the absence of any controlled studies of the management of NCSE, clinicians must balance the potential but rare neurological morbidity associated with NCSE against the not infrequent morbidity caused by IV-AEDs, especially cIV-anesthetic drugs.
UNITED STATES

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INDIA

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Globally neurocritical care is a well-established field in medicine. In India this discipline has developed in the major cities however elsewhere is found wanting. The high incidence of, head trauma, stroke and advances in neurosurgical techniques clearly warrant the need for neurocritical care units.

India is a vast country with a population of over 1.2 billion people, is still rising by about 18 million people a year. The total health care provision is not a centralised process. The government plays a very small role in the total delivery of the healthcare; it neither has control over the non-governmental sector. Only a small proportion of publicly funded government hospitals are able to provide state of the art care, whereas a large percentage of public hospitals only provide basic care. This is due to the fact that India currently spends only 3.9 per cent of its GDP on publicly funded health care. Most of the health care in India is currently provided via the private sector.

There are large numbers of neurocritical centres across the country but most of the neurocritical care patients are treated in general ICUs. In an Internet based survey conducted by the author in 2013 with a web-based Indian Critical Care discussion group of the 162 respondents 59 (36.42%) stated they had exclusive neurocritical care units.

Critical care in India started in the early 1960s and it was initially introduced in the city of Mumbai. It slowly and gradually spread to other cities and towns. A formal society of critical care, the Indian Society of Critical Care Medicine (ISCCM) was formed in 1992 and now has 7,065 members.

The Neurological Society of India (NSI) had a much earlier start and came into existence in 1951. Eminent neurosurgeons and neurologists of that era started this society. The NSI currently has 2,565 members of whom 1,983 are neurosurgeons and the rest are neurologists. In 1992, the neurologists decided that they certainly had to have an identity of their own, which then led to the formation of the Indian Academy of Neurology, which now has a membership of 1,323. For many years, neurocritical care was considered to be essentially a part of the neurosurgical ICU or neurosurgical recovery room, with well-established protocols for managing such patients. It is believed that there may be 100 to 125 neurosurgical ICUs in India, but the distribution of these centers may not be uniform.

Road traffic injuries are the leading cause (60%) of TBIs followed by falls (20%-25%) and violence (10%). Over 80% of accident victims do not achieve access to medical care within 1 h of the incident. At present there are eight stroke registries based in various states of India.

The proportion of stroke patients reaching hospital within 3 hours in India is 15%.

Conclusion: Neurocritical care is a well-established specialty in the developed world. The success of the speciality is due to integration of various sub-specialities namely neurology, neurosurgery, Neuro-anaesthesiology, Interventional Neuro-radiologists and Neuro-critical care consultants.
KOREA

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Critical care medicine has evolved rapidly over the last two decades, with therapeutic and technological advances leading to improved outcome in a wide variety of life-threatening conditions. Neurointensive care has developed as a subspecialty of intensive care medicine dedicated to the treatment of critically ill patients with primary and secondary neurological disease. Neurocritical Care burdens the developing countries, at times heavily and without the necessary resources, training, and facilities to provide the essential care compared to developed countries. Korean neurocritical care occupies middle position between developed and underdeveloped countries. Neurological patients admitted to medical ICU and neurosurgical patients admitted to general surgical or neurosurgical ICU. All patients with severe neurological illness were treated in general ICU and small proportion of them in dedicated neurosurgical ICU. In this setting, ICUs require an increasing input from neurologists, especially with regard to the assessment of hypoxic brain damage and the neurological complications of organ failure, critical illness, and sepsis. Ischemic stroke and hemorrhagic stroke, subarachnoid hemorrhage, severe brain injury, and epilepsy are major causes of morbidity and mortality in Korea. In general, NICU patients with primary neurological diseases such as myasthenia gravis, Guillain-Barré syndrome, central nervous system infections, status epilepticus, and stroke have a better outcome than those patients with secondary neurological disease seen on general ICUs.

Korean ICUs contain a variety of specialized equipment, which may from one unit to another, but the cost of ICU supported by medical insurance was very low which is not sufficient to cover all care cost in ICU. Therefore, equipment used in ICU is variable in each ICU according to each hospital. The cost of ICU in Korea is less than 150 US dollars and it is too low cost to cover all cost of ICU care (I will be 280 US dollars in Sep 2015).

NICU patients remain dependent on ICU support for very much longer periods of time. This results in very significant psychological demands on the patients, their carers, the nurses, physicians, and other health care professionals. In this review we will consider the rationale for managing acute neurological conditions in a dedicated NICU environment. Neurocritical care program provide multidisciplinary intensive care for critically ill neurological patients and improve the outcome. In Korean ICU setting, ICUs do not have sufficient resource for physician, nurse, social worker, and rehabilitation specialist. Full-time faculty members are essential in NICU. However, small number of them works in large tertiary University Hospital and trained in other countries. Korea need more comprehensive neurointensive care training with neurology residencies or an alternative training track for interested residents and nurses.

Korea ICU care system occupies middle position and is changing to the advanced modern ICU system.
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Background Neuronal cell death is occurred by brain ischemia, hypoxia, ischemia/reperfusion, head injury and hyperpyrexia. These causes are strictly related to brain energy failure, lactic acidosis, reperfusion injury (free radicals) 1,2, activating immune/inflammatory cells (hyper-cytokines, free radicals and enzymes) 3,4. In the clinical settings, these multiple factors are related to each other and to the neurological outcome of the patients 3-5.

Methods and results: In the present lecture, managements of neuro-critical patients will be discussed with the patho-physiological and the neuro-chemical data of our basic and clinical researches1-10). Because the neuro-patho-physiology is complex and overlapped, none of a simple treatment, such as a Ca2+ blocker and a n-methyl-d-aspartate receptor antagonist for excite-toxicity could show beneficial effects in the clinical trials. How to control oxygen transport, cerebral blood flow (CBF), cerebral metabolic rate (CMR), blood brain barrier (BBB), reperfusion injury (free radicals) 2,6,8,9, and hyper-cytokines in the brain and blood 6,8-9 will be shown. Some simple effective methods against those pathophysiological pathways are needed for the neuro-critical patients to get favorable neurological outcome. One of the simple methods is therapeutic hypothermia under well controlled CBF, CMR and core body temperature. The methods to success therapeutic hypothermia, such as selection of the patient, anesthetics and cooling methods will also discuss in the present lecture 10.

Conclusion We need to think about neuro-patho-physiology, including CBF, CMR and BBB as basic supports, and free radicals and cytokines as advanced supports to manage neuro-critical patients in the ICU. So far, targeted temperature managements (fever control and therapeutic hypothermia) are the simplest and the best managements to expect favorable neurological outcome in patients with severe brain insults.

Neuro-Critical Care in Patients with Acute Brain Insults

A. Energy failure Neuro-Critical Care

1. Oxygen Transport
   O2: hypoxia : hyperoxia (short duration) or normoxia
   Hb: anemia : Hb>12g/dl, high cardiac output
   hemolysis(Fe2+: Fenton reaction) : haptoglobin, free radical scavengers

2. Cerebral Blood Flow
   CO2 response : PaCO2: 35~40 mmHg (alpha stat)
   auto-regulation : blood pressure: daily BP,
   : relatively low BP (TBI), high BP (SAH)

3. Cerebral Metabolism
   hypothermia, hyper-pyrexia : normo-thermia, hypo-thermia
   seizure (uncoupling) : anti-convulsants

JAPAN
hypoglycemia, hyperglycemia: normoglycemia
excito-toxicity: (NMDA antagonist)
4. blood brain barrier (BBB)
free radicals: free radical scavengers:
urinastatine, hyperoxia (short duration),
hypothermia, normoglycemia
brain edema: osmotherapy: mannitol/glycerol, hypothermia

B. Head Injury, Brain Ischemia/Reperfusion
5. axonal injury: nothing to do in ICU
6. reperfusion Injury
ischemic tolerance: heat shock protein
free radicals: free radical scavengers;
(allopurinol), urinastatine, vitamin C/E,
hyperoxia (short duration), normoglycemia,
hypothermia

C. Pyrexia: normothermia, NSAID ???

D. Cytokine Encephalopathy
7. Hyper-cytokine in blood and the brain/CSF
In blood: immuno-suppressants;
Ciclosporin?, tacroliumus?, steroid?,
In the brain/CSF: hypothermia
BRAZIL

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SYSTEMIC COMPLICATIONS OF NEUROLOGICAL INJURY

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HEMODYNAMIC AND NEURO MONITORING FOR PATIENTS WITH NEURO TRAUMA

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Patients with severe traumatic brain injury require an advanced and intense ICU monitoring in order to minimize secondary neuronal injuries. Cerebral contusions are often hemorrhagic in nature and may expand its volume along with potentially fatal cerebral edema and even brainstem herniation. Incidence of Intracranial hypertension is not uncommon and often refractory to conventional medical therapies. It is critical to assess delivery of oxygen, optimize cerebral perfusion pressure and ensure adequate partial brain oxygen tension in order to create an optimal environment for injured brain to have the best chance to recover.

Literature reviews on hemodynamic as well as multiple modality brain monitoring including MAP, ICP, CPP, PbtO2, CO, HR, intravascular volume metrics and near infrared light tagged sound wave technology for assessing cerebral blood flow in a non-invasive fashion have been performed.

Patients with severe brain injury due to trauma requires multiple methods of careful and continuous monitoring. A recent technology on light-tagged sound wave to assess cerebral blood flow may be utilized in order to noninvasively monitor blood flow to injured brains.

Both hemodynamic as well as cerebral blood flow optimization may be beneficial to minimize secondary brain injury and confer survival and the best possible functional outcome.
NEUROPROTECTION IN TRAUMATIC BRAIN INJURY: SCIENTIFIC FACT OR SCIENCE FICTION

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Traumatic brain injury (TBI) is a major cause of morbidity and mortality worldwide. Advances in protocol-driven therapy have improved outcomes for patients with severe TBI. However, there remains no specific pharmacological intervention that has been clearly shown to improve long-term functional outcome. Great advances have been made in the understanding of cellular mechanisms of primary and secondary brain injury after TBI and this has led to substantial work in pre-clinical models of TBI, primarily in rodents. The concept of neuroprotection derives from focused intervention targeting one or more of these cellular injury mechanisms. Numerous neuroprotective agents and interventions have been studied including excitatory amino acid antagonists, free radical scavengers, calcium channel blockers, corticosteroids, mild hypothermia, and most recently progesterone. However, despite substantial benefit in preclinical models, no phase III trials have been positive in humans. This talk will explore the promise of neuroprotection, address some of the lessons learned from prior clinical research, and consider future directions.
HYPEROSMOTIC THERAPY: MANNITOL OR HYPERTONIC SALINE?

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MANAGEMENT OF INTRACRANIAL HYPERTENSION IN TRAUMATIC BRAIN INJURY

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The injured brain has limited capacity to accommodate pathological increases in intracranial pressure (ICP) due to non-elastance of the skull and dura. While increased ICP is recognised as the principal mechanism of neuronal loss following trauma, the processes by which intracranial hypertension develops are complex and multifactorial, including cellular, humoral and vascular mechanisms.

Despite phase I and II animal studies that have demonstrated attenuation of neuroinflammatory responses with modulating agents, none of these agents have been shown to improve patient-centred outcomes in subsequent phase III clinical trials. Similarly, brain-specific therapies, such as osmotherapy, induced hyperventilation, barbiturate coma and induced hypothermia targeted at reducing ICP under the guidance of mono- and multimodal monitoring have failed to demonstrate consistent reductions in mortality or improvements in functional survival. As a consequence, the efficacy and safety of established brain-specific therapies are increasingly questioned with little substantive evidence to support their use apart from being options for the treatment of intracranial hypertension within guideline bundles.

Insights into this dilemma are emphasised in the recent DECRA study, where the use of early decompressive craniectomy in patients with diffuse axonal injury resulted in clinically and statistically significant reductions in ICP but a paradoxical significant increase in the proportion of patients with unfavourable outcomes.

Furthermore, there are no standard or validated treatment bundles for the treatment of intracranial hypertension that have been shown to improve functional survival.

The recent landmark BEST-TRIP study demonstrated no significant difference in functional survival between patients with TBI managed with an imaging/clinical examination strategy vs. a ICP pressure-monitoring strategy, although the latter group was associated with prolonged use of brain-specific treatments.

Outcome from TBI is largely determined by the severity of primary brain injury and associated hypoxic/ischaemic secondary brain injuries, age and likely genotypical predisposition. Few of these are modifiable once patients enter the health-care system, apart from prompt and effective resuscitation.

It is not surprising that the role of ICP monitoring remains questionable apart its use as an index of intracranial elastance reserve. Therapies directed at reducing ICP may result in transient improvements in intracranial elastance, but these are not associated with improved functional survival and may potentiate adverse outcomes in selected patients.
HYPOTHERMIA FOR MALIGNANT INCREASED INTRACRANIAL PRESSURE

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Increased intracranial pressure after brain injury is a major problem in neurocritical care causing death if uncontrolled. Because of this reason, there are many trials to control of intracranial pressure such as decompressive craniectomy, steroid, hypertonic saline and induced hypothermia. Induced hypothermia is the well established their neuroprotective effect experimentally, but its clinical use is limited to selected indications

The mechanisms of induced hypothermia to reduced elevated intracranial pressure were thought to be the reduction of metabolism and perfusion and the reduction of edema besides others. But it makes another problems, such as infection, arrhythmia, hypokalemia, and the thrombocytopenia. Studies have indicated that therapeutic efficacy is sufficient for ICP control at mild hypothermia of 35°C, thus minimizing detrimental effects and stressed the importance of prolonged hypothermia(48 hours to 5 days) and slow rewarming (<1°C/4 /hours)

We discuss of clinical trials and protocols to induced hypothermia and there positive and negative effect to increased intracranial hypertension.

Inspite of many controversy, induced hypothermia may give us to some benefits to controlled malignant increased intracranial hypertension, but stull needs to prove their optimal use in clinical area.
HOW TO ACHIEVE ABDOMINAL PERFUSION PRESSURE?

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Elevated intra-abdominal pressure (IAP) has been identified as an independent predictor of mortality in critically ill patients and plays a major role in the development of multi-organ failure. Abdominal compartment syndrome (ACS) is a cause of significant morbidity and mortality in critically ill surgical and medical patients. The effects of IAH are not limited just to the intra-abdominal organs, but rather have an impact on every organ system in the body. As a result, patients with sustained IAH commonly manifest significant hypoperfusion and organ dysfunction. Especially, the perfusion of intra-abdominal organ such as kidney, bowel, and liver are directly affected by IAP.

The abdominal perfusion pressure (APP) is the difference between mean arterial pressure (MAP) and IAP. The APP is a surrogate of the perfusion status of intra-abdominal organs and its decrease might be the major pathophysiologic mechanism of underlying regional hypoperfusion and organ dysfunction. The APP was suggested as a more accurate predictor of visceral perfusion and a better goal of resuscitation than isolated values of IAP or MAP. Although APP is statistically superior, it remains unclear if improving or increasing APP results in improved outcomes.

To achieve abdominal perfusion pressure, application of comprehensive management strategies to reduce elevated IAP or to increase MAP are needed. Because the various patient populations may develop IAH/ACS with a various mechanism, it is difficult to make a standardized therapeutic approach. Physicians should consider pathophysiologic mechanism leading to IAH and should apply appropriate management strategies to the patients.

In the patients with IAH or ACS due to free intra-abdominal fluid, air, abscess, or blood, removal of intra-abdominal contents procedure such as insertion of percutaneous catheter drainage appears to be effective in reducing IAP and potentially correcting IAH-induced organ dysfunction.

- If patients have large intraluminal contents, administration of prokinetics, nasogastric or rectal drainage, enemas, and even endoscopic decompression would appear to be simple methods for reducing IAP.
- Decreased abdominal wall compliance is possible to be a pathophysiologic mechanism of IAH. In that cases, adequate analgesia, sedation, neuromuscular blockade, and avoidance of head elevation or prone position can reduce muscle tone and potentially decrease IAP.
- Excessive fluid resuscitation, an independent predictor of both IAH and ACS, represents a major etiology for secondary ACS and should be avoided. Diuretics therapy or continuous renal replacement therapy may be an appropriate intervention for the patients with IAH/ACS due to excessive fluid resuscitation.
- The clinical benefits of raising MAP to achieve a particular APP remains unknown. There are no relevant APP management RCTs or meta-analyses. Only few experimental studies have evaluated the benefits of increasing MAP on tissue perfusion and these studies showed the heterogeneous results.
- Surgical abdominal decompression represents a standard treatment when a patients IAH/ACS has become refractory to medical treatment options and organ dysfunction is evident.

A comprehensive evidence-based management strategy that incorporates both operative and nonoperative interventions designed to reduce IAP and to achieve APP is very important to improve the survival of patients with IAH/ACS.
Abdominal compartment syndrome (ACS) is present when organ dysfunction occurs as a result of intra abdominal hypertension (IAH).

ACS is defined as sustained or repeated abdominal pressure more than 20 mm of Hg or APP less than 60 mm of Hg in association with single or multiple organ system failure.

Effects of IAH on pulmonary system and cardiovascular system have significant implications when a patient of IAH/ACS requires to be on mechanical ventilator or when a patient on mechanical ventilator develops IAH /ACS. In both circumstances adjustment of ventilator parameters are required to optimize patient care in addition to other management strategies.

IAH increases intra thoracic pressure leading to atelectasis, airway closure and deterioration of respiratory mechanics and gas exchange. IAH reduces functional residual capacity and decreases overall compliance of respiratory system by reducing chest wall compliance. In patient of mechanical ventilation with evidence of IAH best PEEP should be equal to IAP and required plateau pressure (Pplat) is expected to be equal to observed Pplat minus IAP/2. When IAP is increased both hemi diaphragms are pushed upward resulting in decreased thoracic volume and compliance. Hypoventilatory respiratory failure may occur resulting in hypercapnia, hypoxia and increased minute ventilation requirements with increased ventilator pressures.

The cardiovascular effects of IAH results from abdomino thoracic transmission of IAP and subsequent spurious rise of central venous pressure (CVP) and pulmonary artery occluding pressure (PAOP) which do not reflect true cardiac filling. It is observed that actual CVP is equal to measured CVP minus IAP/2 and actual PAOP is equal to measured PAOP minus IAP/2. When IAP rises, cardiac output drops as a result of decreased venous return secondary to compression of the venacava. Higher intrathoracic pressure also compresses the heart producing reduced stroke volumes and reduced ventricular end diastolic volume. Left and right sided preload (i.e. PAOP and CVP) may increase with rise of systemic and pulmonary vascular resistance and cardiac work load.

A protective ventilator strategy with low tidal volume (6 ml/kg ideal body wt) may lead to alveolar derecruitment in presence of ARDS associated with IAH. In extra pulmonary ARDS with IAH with high tidal volume(10ml/kg ideal body wt) decreases atelectasis and inflammatory response of the lung tissue and improves oxygenation by increasing end inspiratory trans pulmonary pressure. In presence of IAH and increased chest wall elastance, the inspiratory pressure of the respiratory system applied during recruitment maneuvers should be longer than usually applied in order to reopen collapsed alveoli.

Optimal ventilator management of patients of ARDS with IAH would include, a) intra abdominal, esophageal pressure and hemodynamic monitoring, b) ventricular settings with protective tidal volume, recruitment maneuvers and PEEP level set according to the best compliance of the respiratory system or the lung, c) deep sedation with or without neuromuscular paralysis in severe ARDS and d) open abdomen in selected cases with severe ACS.
DECOMPRESSIVE LAPAROTOMY, WHEN? HOW?

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Damage control surgery which is defined as leaving the abdominal fascia open to be closed later during subsequent laparotomies has become common place. However the data showing the effectiveness of damage control laparotomy is lacking. With the wide spread use of damage control laparotomy for trauma, this has now spread to its use in non traumatic settings. However this approach has led to increase costs and the evolution of the complex open abdomen with its complications such as the enterocutaneous fistulas. The treatment of the explosion of the resulting ventral hernias has become a mainstay of general surgery. However, it has recently been shown that the avoidance of damage control surgery results in better survival and decreased costs as well as decreased complications from the open abdomen. The reason why damage control laparotomy can be avoided is due the evolution of damage control resuscitation which has resulted in improved outcome in trauma. Damage control resuscitation uses the concepts of permissive hypotension, aggressive use of blood products for resuscitation, total avoidance of crystalloid resuscitation, use of hypertonic saline, and finally drugs to reverse coagulopathy. This has decreased the incidence of the lethal triad of hypothermia, acidosis and coagulopathy. As a result damage control laparotomy rates have been decreasing as well as abdominal compartment syndrome. This talk will discuss the evolution and disappearance of damage control laparotomy as well as abdominal compartment syndrome. While there may be a need for damage control laparotomy it should be reserved for dire scenarios including situations when the abdominal fascia cannot be physically closed. The indications for damage control laparotomy and decompressive laparotomy will be discussed. There are scenario for the appropriate use of decompressive laparotomies and this includes sepsis when the patient is in multiple organ failure and has been a need for aggressive fluid resuscitations. After decompressing the abdomen with drains if the patient is dying from respiratory hypoxia and renal failure the decompressive laparotomy may provide additional time for treatment of infectious source control with improved survival. However if the abdomen is not closed as quickly as possible the sequelae of the open abdomen may ensue.
CAN WE PREVENT INFECTIOUS COMPLICATIONS IN THE OPEN ABDOMEN?

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Now, the open abdomen, originating from the concept of damage control surgery, has emerged as a common tool in the management of severe abdominal trauma. This treatment also has become an important approach for critically ill patients who require emergent abdominal surgery. The open abdomen itself has a high potential for infection, either from intraabdominal infection or from exposure to the environment. With the advance of critical care in those patients, mortality has steadily declined. But, the morbidity associated with infectious complications from open abdomen remains high. Generally, definitive fascial closure is recognized as the ultimate goal of the open abdomen. Nonetheless, patients with infectious complications are less likely to achieve an early fascial closure. The incidence of abdominal infection/abscess depends on a complex set of factors, the extent of traumatic injuries and bowel pathology (i.e., contamination, perforation, ischemic bowel), as well as the timing and method of wound closure, and so on. Therefore, preventing infectious complication, we have to employ proper strategies in management of open abdomen, including effective and various methods for source control, temporary abdominal closure and early wound closure.
Abdominal compartment syndrome is the serious complications in critically ill surgical patients with traumatic hemorrhagic shock and intra-abdominal sepsis. After introducing the damage control surgery, open abdomen is the main option to prevent the intra-abdominal hypertension and abdominal compartment syndrome. A variety of techniques of temporary abdominal wall closure have been described as follows: sandwich technique (VacPac), Bogota bag, towel clips, and vacuum-assisted closure (VAC). However, Bogota bag and towel clips are no longer used for temporary abdominal closure. Recently, tension-free fascial closure with synthetic mesh, biologic mesh are earlier applied to maintain intra-abdominal pressure below 12 mmHg with vacuum pack or negative pressure wound therapy.

During maintenance of the open abdomen, fluid loss from the peritoneal cavity, loss of body temperature, injuries of the fascia and skin, bowel adhesion to the peritoneal membrane, and enteroatmospheric fistulas (EAFs) can be occurred. To prevent previously stated complications, recently Vacuum pack with negative pressure therapy system was developed and applied universally. By the several studies, negative pressure therapy showed the higher closure rate, lower complication rate and mortality compared to other technique. EAF is one of the serious complications requiring meticulous treatment and resulting in poor outcome. Despite of lower incidence of EAF with NPT, NPT cannot entirely prevent.

To prevent the associated complication with open abdomen, several techniques can be used.

1) Protection of the adhesion of the bowel and peritoneal membrane : use the polyvinyl chloride bag to cover the entire bowel below the peritoneal membrane.

2) Control of the fluid loss : use of large bore drainage tube, such as chest tube or Jackson-Pratt drain over the polyvinyl chloride bag.

3) Prevention of tertiary abdominal compartment syndrome : use the porous membrane.

Hematoma can be collected into the abdominal cavity when drainage is not effective. It may increase the intraabdominal pressure leading to abdominal compartment syndrome. And serial monitoring for the abdominal pressure is mandatory during the open abdomen.

4) Protection of injuries of the fascia and skin : no use of suture or stapler, wound coverage with occlusive dressing, such as loban or transparent films.

5) Prevention of EAF : close the open abdomen as soon as possible after resuscitation and stabilization of the patients. The risk of EAF is increased as the closure time is delayed. And low negative pressure (maximum < 50 mmHg) can be helpful to reduce the occurrence of fistula. To prevent the EAF, bowel protection using separation membrane such as polyvinyl bag or sheets from the vacuum pack is necessary.

6) Prevention of infection : perioperative wound infection is the major cause of the death after open abdomen. Frequent change of the vacuum pack may induce the damage of the bowel and increase the risk of infection. However, planned re-exploration should be considered within 24-48 hours.

Several methods can be applied to maintain the open abdomen and temporary abdominal closure. However, careful management should be performed to prevent the complications resulting in poor outcome.
RECONSTRUCTION OF THE ABDOMEN

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The abdominal reconstruction is often required after trauma, hernias, cancer resection, infection, and other complications after surgery. The goal is to restore the structural and functional continuity of the musculofascial system and to provide stable and durable wound coverage.

The treatment may involve multi-staged approach especially for infected wounds. Negative pressure wound therapy (NPWT) plays an important role in reducing bioburden and maintaining the open abdomen at a relatively clean state. Primary skin closure can be effective in small wounds after repairing the abdominal wall. The wall can be approached with prosthetic meshes, bioprosthetics or autologous fascial grafts. Component separation which mobilizes rectus abdominis musculofascial flap in a bipedicled approach. Other methods of reconstruction involves mobilizing regional or distant tissue as a flap. Frequently used fasciocutaneous flaps are the anterolateral thigh flap. In recent years, using the abdominal wall as part of the multiorgan transplant has been also reported.

Reconstruction of the abdominal wall remains to be difficult. Knowing the etiology, relevant anatomy and selecting the right surgical protocol is the key.
PERFORMANCE IMPROVEMENT IN DIAGNOSIS AND MANAGEMENT OF SEVERE SEPSIS

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Introduction: Since the Emergency and Medical ICU was opened in Nagoya University Hospital on 1st May 2011, we set up some ICU management bundle containing infection, septic shock, immune protection, and systemic fibrosis. In this session, sepsis management bundle will be introduced.

Contents: In a practice of severe sepsis and septic shock, 13 main branches and 6 sub branches were combined as the management bundle of septic shock and severe sepsis. The main branches include standard precaution, bactericidal antibiotics usage followed culture sampling, infusion therapy adjusted with echocardiogram, early goal-directed original infusion methods, lactate clearance, open lung strategy, analgesia and sedation, β-adrenergic receptor non-stimulation, urine volume management, continuous hemofiltration with CHF and PMX-DHP, early enteral nutrition within 48 hours, and early rehabilitation. We analyzed an outcome of 96 cases of septic shock from 1st May 2011 to 31st December 2014. The sex ratio was 63:33, mean age was 64.6±18.7 years old, mean ICU stay was 11.6±13.4 days and APACHE II score was 28.6±7.8. The shock withdrawal rate was 99.0%, and in-ICU mortality and 28 day mortality was 5.2% (n=5) and 6.3%(n=6), respectively. The main causes of death were DNR order with intra-abdominal infection, intestinal necrosis and soft tissue infection. The sepsis management outcome was significantly improved in the bundle management term as compared with in non-bundle management by 2010 at 28-day mortality rate of more than 25%.

Conclusions: The sepsis management bundle NAGOYA 2015 will be introduced in this symposium. A high survival was obtained with the sepsis management bundle as compared to our management in 2010. A bundle management could improve the clinical performance against severe sepsis and septic shock.
THE SURVIVING SEPSIS CAMPAIGN: AN UPDATE IN 2015

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The Surviving Sepsis Campaign (SSC) was initiated in 2004 (by the ESICM and the SCCM) with the aim of improving the outcome of patients with sepsis (by 25%) through improved awareness of the condition, education and the adoption of evidence-based practices. Towards these aims the SSC produced its first set of evidence-based guidelines in 2004 and these have been updated in both 2008 and 2012. The SSC guidelines panel is currently working on the next (2016).

The SSC guidelines contain many recommendations as to what a summary of the evidence suggests best practice should be. These documents are long and often are not well adopted. The SSC therefore partnered with the Institute for Healthcare Improvement (USA) to develop tools to improve the translation of the evidence-based guidance into clinical practice. The main tool involved with this was the sepsis bundle. A bundle is a group of interventions that when implemented together improves clinical outcomes. Recent evidence has suggested from the SSC database that those hospitals that have adopted such quality improvement initiatives improve their compliance with bundle metrics and that this improved compliance translates through to better outcomes. In addition it has been shown that better compliance and longer participation are both associated with additional outcomes improvements.

If we review the guidelines over time it can be seen that they have changed significantly since the 2004 version. Many important components of the first set have subsequently been dropped or revised. This should not be seen as a weakness, as it is in fact a strength of the process. As more areas of clinical practice are subject to scrutiny and debate, new clinical trials are performed and new data changes the way the overall evidence base is viewed. Key areas of change over the last 12 years include the dropping of the recommendation for activated protein C and the revising of the recommendations for tight glycaemic control and low dose corticosteroids. In the last 12 months we have seen three large studies published looking into the efficacy of early goal directed therapy for the resuscitation of septic shock. None of these studies have demonstrated a positive benefit to patients with this approach and the current guideline update is going to have to reflect this change to the evidence base.

One of the strengths of the SSC guidelines process is the involvement of over 30 international societies who have an interest in this problem. This interest, however, also creates problems. One area that the guideline panel is keen to develop is the speed the guidelines respond to changes in the literature. Four years is a long time to wait for a new update if the evidence suggests change needs to happen. Making the process more nimble (and living) is therefore important but this may have implications when the panel is structured so that so many different societies have input into the governance processes. It may be that this will have to change.
SEPSIS - DEFINITIONS RECONSIDERED

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Formal definitions of sepsis and septic shock were first developed in 1991 and were revised in 2001. They have not been modified since. Therefore, in 2013 the SCCM and the ESICM convened a Task Force to revisit and revise these definitions. The Task Force specifically sought to differentiate sepsis from uncomplicated infection, and to update definitions of sepsis and septic shock to be consistent with our improved understanding of the pathophysiology. Further, we sought to provide practitioners with evidence-based consensus criteria to aid in the early identification of infected patients who were highly likely to develop sepsis or septic shock. On this lecture we will discuss the new definitions, the methodology used to develop evidence-based identifying criteria and the nature and limitations of these criteria.
THE SEPTIC PATIENT: WHAT SHOULD WE MONITOR?

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The key goal of treatment of the patient with sepsis or septic shock is to restore adequate tissue perfusion. However, without a direct means of monitoring tissue perfusion and oxygenation, it is difficult to determine which variables to target to achieve this goal. Clinical indicators of adequate tissue perfusion include well-perfused skin, adequate urine output, and adequate mentation. Global hemodynamic variables can provide some indication of regional perfusion but may be normal even in the presence of an altered microcirculation. The last Surviving Sepsis Campaign guidelines recommended initially targeting a central venous pressure of 8-12 mmHg, a mean arterial pressure > 65 mmHg, a urine output > 0.5 mL/kg/h and a central venous or mixed venous oxygen saturation (ScvO2 or SvO2) >70% or >65%, respectively, for resuscitation in patients with sepsis. However, these are general, simple guides and need to be adapted according to the individual patient because what may be adequate for one patient may be insufficient or excessive for another. The recent negative large randomized controlled trials do not eliminate the need to check the ScvO2 to guide therapy in complex cases. Blood lactate levels should also be monitored regularly and therapies should be targeted at normalizing blood lactate levels, keeping in mind that normal lactate levels are close to 1 mEq/L. Techniques to visualize the microcirculation are becoming available, and microcirculatory monitoring in one form or another is likely to become more widely used in the future, although further study is needed to clearly define whether targeting the microcirculation can improve outcomes. Importantly, clinical, hemodynamic and oxygenation parameters should be integrated to provide a full picture of the ongoing status and response to therapy of each patient.
EPIGENETICS IN SEPSIS

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WHAT'S NEW IN HEMODYNAMIC MANAGEMENT?

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COAGULATION AND ANTICOAGULATION DURING ECMO

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Extracorporeal membrane oxygenation (ECMO) is commonly used to support patients with respiratory and/or cardiac failure. Despite the improvement of ECMO circuit, however, complications of bleeding and thrombosis are still ongoing issues. Recently evidence has shown that acquired von Willebrand disease (aVWD) and hyperfibrinolysis are the etiologies of bleeding. Although the mechanism of these conditions are not fully understood, administration of von Willebrand factor concentrate (Humate-P™) or antifibrinolytics may be effective to control bleeding in the setting of adequate anticoagulation, underlying coagulable state, and platelet count. Unfractionated heparin (heparin hereafter) is mostly used as an anticoagulant for ECMO. Although heparin by continuous intravenous infusion is easy to control, it is known that heparin has a poor bioavailability due to non-specific binding to other plasma proteins. Anticoagulant effect of heparin is not only making a complex with antithrombin, but also attributed to the release and possibly synthesis of tissue factor pathway inhibitor from endothelial cells and making a complex with heparin cofactor II. Monitoring the heparin anticoagulant effect is also problematic. Values of activated clotting time (ACT), activated partial thromboplastin time (PTT), and anti-factor Xa (anti-Xa) may not always agree. ACT is neither accurate nor precise. PTT is affected not only by coagulation factors and heparin, but also other proteins such as lupus anticoagulant and C-reactive protein. Anti-Xa value is falsely decreased when there is hemolysis or hyperbilirubinemia. Using thromboelastometry (ROTEM™) or thromboelastography (TEG™) may give additional information on coagulation and anticoagulation in some cases. However, neither of these can detect aVWD. In addition, neither of these may be sensitive enough to detect clinically significant hyperfibrinolysis. The use of antithrombin concentrate or recombinant antithrombin has been increased dramatically in the past 10 years. However, there is no randomized controlled study to show the clinical efficacy of increasing antithrombin level. In addition, optimal antithrombin level in the setting of ECMO has not been well established. Therapeutic plasma exchange (TPE) is used to remove plasma free hemoglobin when it is markedly elevated since it may cause renal damage and hemostatic derangement, mostly thrombotic tendency. TPE has been also found to be effective to reset hemostatic derangement such as removal of lupus anticoagulant and increased factor VIII, both of which are risk factors for thrombosis. In the future, use of factor XII inhibitor and novel tubing system coated by thrombin inhibitor such as argatroban and platelet inhibitor such as nitric oxide may be promising in order to decrease bleeding and thrombotic complications.
ECMO PAST, PRESENT, FUTURE

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ECMO CARE: PROMOTING BEST CARE PRACTICES

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Extracorporeal Membrane Oxygenation (ECMO) was initially used to describe long-term extracorporeal support that focused on the function of oxygenation and subsequently, in some patients, the emphasis shifted to carbon dioxide removal, then post cardiac surgery support. With all of these uses for extracorporeal circuitry, a new term, extracorporeal life support (ECLS), has come into vogue to describe this technology. It was first used in human in OR for ASD in 1953. The first successful ECLS patient was treated in the US in 1971. In 1972 & 1975 successful implementations of ECMO on paediatric cardiac cases and neonatal cases were reported respectively. ECMO became standard practice for neonates, paediatrics and adults from 1990-2000. Publication of the CESAR trial in 2009 led to a significant growth in the use of ECMO for ARDS cases.

Most common configurations in ECMO are VV-ECMO and VA-ECMO. Indications for initiation of ECMO include i) as temporary support for the failed lung or heart; ii) In acute severe cardiac or pulmonary failure that is potentially reversible and unresponsive to conventional management. Contraindications include i) lung conditions requiring long time to heal (in case of complications, risk > benefit); ii) pre-existing conditions that affect the quality of life; iii) age & size of patient; iv) futility. Murray Score further defines the inclusion criteria in 4 parameters: i) PaO2/FiO2 (On 100% O2); ii) CXR; iii) PEEP (cmH2O) & iv) compliance (ml/cmH2O).

Extracorporeal Life Support (ECLS) Registry Report in January 2014 depicts a total of 58,842 patients (Neonatal, paediatric and adult) were treated with survived ECLS 72% and survived to DC or transfer 60%. Hong Kong started to use ECMO in Open Heart Surgery in 1964. ECLS program were introduced widely in 2010. Altogether, 5 ECMO Centres in public hospitals and 2 private hospitals are providing 24x7 coverage for both VV-ECMO and VA-ECMO service to critically ill adult patients.

An overview of ECMO would include a brief introduction of the service and trend of ECMO use worldwide. Starting from the ECMO service development in Hong Kong and the ECLS programs conducted in Hong Kong, the retrieval service, will be introduced; the advanced nursing practice in ECLS service; ELSO Guidelines for ECMO Centres on ECMO specialist; the requirements of an advanced practice nurse (APN) in ECLS Program; credentialing for the advanced practice ; and roles of an APN in ECLS program would be mentioned. The future of the ECMO service would be discussed.
ECPR IN JAPAN

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Favorable outcomes in patients receiving extracorporeal cardiopulmonary resuscitation (ECPR) for out-of-hospital cardiac arrest (OHCA) have been frequently reported in Japan since the late 1980s. This time summary of the previous study related to ECPR in Japan by SAVE-J study group are introduced.

First, SAVE-J study group reviewed all previous reports during from 1983 to 2008 in Japan to clarify the survival rate of patients receiving ECPR. The survival rate at discharge was 26.7±1.4%.

Second, SAVE-J study group prospectively examined how ECPR for OHCA with VF/VT would affect neurological outcomes. A prospective, observational study was performed to compare differences of the rate of favorable outcomes defined by the Glasgow-Pittsburgh Cerebral Performance and Overall Performance Categories (CPC) 1 or 2 at 6 months after OHCA between ECPR group and non-ECPR group. Based on intention-to-treat analysis, CPC 1 or 2 were 11.2% in ECPR group and 2.6% in the non-ECPR group (P = 0.001), respectively. In OHCA patients with VF/VT on the initial ECG, a treatment bundle including ECPR, therapeutic hypothermia and IABP was associated with improved neurological outcome.

In addition, the questionnaire study related to ECPR technique and experiences of ECPR in the single emergency hospital during recent 25 years are demonstrated.
ECPR IN KOREA

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Venoarterial (VA) extracorporeal membrane oxygenation (ECMO) provides highly effective circulatory support. Extracorporeal cardiopulmonary resuscitation (ECPR) is defined as use of ECMO in the situation of cardiac arrest. After establishment of VA ECMO, ECMO rapidly mobilize the intravascular volume and the effective circulation can be achieved. ECPR serves as more strong and effective resuscitation modality than conventional CPR using chest compression. However, there are a few drawbacks in ECPR. ECMO requires time to be established (generally 5~30 minutes), ECMO-trained people, and special equipment. As a side effect, many patients become neurologically poor with intact cardiopulmonary function. The insurance system will bear high burden of resuscitation cost which may cause increase of amount of premium and copayment.
ECMO technology is widely distributed in the German health system with far more than 100 hospitals providing ECMO service for both pulmonary and cardiac failure. It is well known, that probability of achieving return of spontaneous circulation decreases rapidly after 10 minutes and is almost nil after 30 minutes. Several studies showed improved survival with good neurological outcome in selected patients with the use of extracorporeal life support systems (ECLS) during resuscitation (1). For in-hospital cardiac arrest (IHCA) success rates of 30 - 40 % have been reported. There is a clear linear correlation between time from cardiac arrest to ECLS flow and outcome, which makes the permanent availability of a well organized ECMO team very important. If possible, the period from cardiac arrest to start of ECLS should be below 40 minutes. A decision pro or against E-CPR should be taken after 10 minutes of unsuccessful conventional resuscitation.

Problems of VA ECMO are manifold and include cannula-associated complications like ischemia, vessel injury and thrombosis. After return of spontaneous circulation, a Harlekin-syndrome can occur with insufficient oxygen support of brain and coronaries. Loading of the left ventricle due to a high afterload is an inherent problem of peripheral VA-ECMO, and bleeding is very common due to platelet consumption and decreased platelet function. All these complications negatively influence the survival of the patient and have to be recognized and addressed at the earliest possible moment. The Regensburg ECMO Center developed a modified approach to E-CPR under the motto less is more. With the use of 15 Fr arterial cannulas, the occurrence of leg ischemia can be reduced; a reduction of blood-flow on ECMO below 3.5 L/min decreases afterload and avoids the need of mechanical unloading (venting) of the left ventricle. Because flow is more important for oxygen delivery than pressure, vasopressors are reduced and inotropes increased to achieve a mean arterial pressure between 50-60 mmHg. Intensive monitoring with NIRS on brain and leg and echocardiography is mandatory. Preliminary results of this approach are reported.

The use of E-CPR for out-of-hospital cardiac arrest (OHCA) is under discussion. In well selected patients good outcome may be seen in 1520 % (2). The most challenging problem in OHCA is the transport of the patient with ongoing resuscitation in a short period to the emergency department. Therefore, we have initiated a prospective pilot trial, which investigates the impact of a mobile ECMO team with a fast response car, bringing ECLS to the patient instead of transporting a patient to ECLS.

In summary, E-CPR is increasingly used in Germany for IHCA; whether it will be a sensitive approach for OHCA also, has to be shown in the future.

Literature
ECMO CPR; FUTURE FORM OF CPR?

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Extracorporeal membrane oxygenation (ECMO) had been applied for many critical situations. Since the improved results of ECMO application in various filed, more and more physicians had tried to apply ECMO in arrested patients as a resuscitative tool. The initial outcome is not encouraging till the advancement in the technology and the concept of CPR.

Manual resuscitation only provides basic survival in the first stage. Hypothermia may increase the short-term survival after initial resuscitation. Advanced mechanical support had change the connect of CPR.

We started our ECMO application in CPR since 1994, and the accumulated experience in the first 5 years had encouraged us to re-organize the ECPR team as an adjunctive team of in-hospital CPR program. We usually applied the ECMO for those failed to return of spontaneous circulation (ROSC) in 10 to 20 minutes. We have 135 adult ECPR patients in 12 years with 34.1% survival to discharge. Most of the survivors (89%) had good neurological status. The risk factor analysis revealed longer CPR duration, etiology of acute coronary syndrome, and the high organ failure score were associated with increased odds in mortality. In the pediatric group, 27 patients were recorded in 7 years with 40.7% survival to discharge. The risk factor analysis revealed longer CPR duration, higher pre-CPR lactate level and renal failure after ECPR were associated with increased odds in mortality. Similarly, 80% of survivors in pediatric group had normal neurological function. Our detailed analysis had clearly demonstrated ECMO can offer an additional 20% survival rate than the conventional CPR. The probability of survival to discharge related to CPR duration demonstrated 10% chance of survival if CPR duration was 90 minutes, which become better compared with our previous published data.

More and more data of ECMO application in CPR has enough evidence to apply ECMO in arrested patients. There is some concern in performing ECPR routinely, but is it ethical to perform randomized trial for these critical patients in such dying condition? It remains further consideration.

The further coming issue is the timing and and target and methodology to improve the outcome in these special groups of patients.
ECMO FOR SEPTIC SHOCK

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ECMO is not a treatment for sepsis, but may be considered as temporary organ support for refractory pulmonary and/or cardiac failure due to sepsis. Many patients with severe lung failure due to infectious causes potentially qualifying for ECMO have concomitant shock and have to be treated with vasopressors. Veno-venous ECMO primarily provides gas transfer and as such supports a failing lung. The primary intend of peripheral veno-arterial ECMO is assistance of the circulation; it may not be able to provide sufficient oxygenation to the brain and coronaries, if it is implemented in severe accompanying ARDS (Harlekin syndrome). Therefore, VA-ECMO is not the first choice in adults with severe sepsis and ARDS. Echocardiographic assessment should be done before cannulation. If shock is due to acute right heart failure in ARDS, VV-ECMO should be started, and often the need for vasopressors will rapidly decline, as the right ventricle improves with normalization of PaO₂, PaCO₂ and pH and reduction of intrathoracic pressures with ultra-protective ventilation on ECMO.

A more complex problem poses a failing left ventricle in sepsis (septic cardiomyopathy), as this condition may improve on VV-ECMO, but not always does. In such a case VA-ECMO may be necessary, often with an additional venous back-flow cannula (VAV-ECMO) to circumvent the problem of the Harlekin-syndrome. Brechot et al reported the use of VA ECMO in 14 adult patients with severe bacterial sepsis and an ejection fraction of 16%; the time of support averaged 5.5 days, and 10 patients were long-term survivors [1]. Some centres used central (atrio-aortic) cannulation with high flow ECMO in such a condition; survival rates of 74% have been reported in children with multi-organ failure due to septic shock [2]. However, it is necessary to emphasize that only retrospective studies from highly specialized centres are available.

Additional problems have to be considered. Sequestration of antibiotics may occur within the ECMO circuit, but reported data are scarce and contradictory [3]. To avoid potential antibiotic failure, dosing at the upper end of the therapeutic range is recommended. Septic shock can be accompanied by disseminated intravascular coagulopathy (DIC). ECMO itself is associated with an increased incidence for bleeding; therefore, in sepsis the risk for severe hemorrhagic complications is high. On the other side, premature clotting of the circuit may happen due to marked activation of coagulation in some cases. Thus, anticoagulation for ECMO is difficult and has to be decided individually.

In summary, ECMO in septic shock is a complex procedure and associated with specific problems, but can be considered as a rescue therapy in patients refractory to conventional therapy.
ECMO FOR TRAUMA

Thomas Bein

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ARDS is frequently associated with severe trauma and concomitant chest injury. In addition to supportive posttraumatic intensive care management (mechanical ventilation, infection control, volume balance, damage control surgery) extracorporeal lung support (ELS) might be an additional treatment option in severe posttraumatic ARDS. The aim of ELS is to improve arterial oxygenation, to correct severe hypercapnia/acidosis and to support lung protective ventilation. In trauma patients the two-cannula-technique (v. jugularis - v. femoralis) establishing pump-driven veno-venous ECMO (vvECMO with blood flow 2-4 l/min) is advantageous compared to the single-cannula-bilumen-technique. Indications for ECMO include life-threatening hypoxemia (PaO2/FIO2 < 80) despite optimal ventilator settings for > 6 h and/or severe hypercapnia/acidosis (PaCO2 > 60/pH< 7.2). Complications are related to insertion of cannulae (bleeding, vascular injury), to artificial membrane (clotting) or to systemic effects (cerebral bleeding, retroperitoneal hematoma). Contraindications for ECMO in trauma patients are severe coagulation disorder/failure due to hemorrhagic shock, severe acute brain injury (GCS < 5) or marked hemodynamic instability (high demand for vasopressors).

In our ECMO center the use of ELS in severe thoracic trauma patients is an accepted interdisciplinary treatment approach (1). In predominantly young patients suffering from severe trauma (ISS > 40) due to traffic accident, blast injury, deep fall, or submersion associated with severe ARDS we observed a prompt increase in oxygenation and a rapid correction of hypercapnia/acidosis. The mean ELS duration is 6 days and cannula related complications occur in approx. 15 %. Damage control or trauma surgery is frequently performed with ELS. Anticoagulation is managed with heparin (goal parameter: activated partial thromboplastin time [aPTT] ca. 50 sec). No excessive bleeding or demand for transfusion is observed. The overall survival rate (> 70 %) is higher compared with the proposed ISS-related survival rate.

The use of vvECMO in patients after posttraumatic ARDS is an increasing treatment option for experienced ECMO and Trauma-Centers, resulting in better oxygenation and improved short-term outcome. Expertise, interdisciplinary strategy and early identification and management of complications is needed.

IS ECMO AN ALTERNATIVE IN MIDDLE-INCOME COUNTRIES?

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ECMO (extracorporeal membrane oxygenation) is an increasingly common system of extracorporeal life support in catastrophic pulmonary failure, acute heart failure and resuscitation. ECMO allows the heart or lungs time to rest and heal, providing opportunity for recovery. Technological advances have made ECMO devices smaller, less invasive, and easier to use.

Although ECMO therapy in adult patients was incorporated several decades ago in Latin America, this practice was scarce and limited to a few centers with a small number of annually cases. Therefore during the 2009 H1N1 pandemic the results of its use were disappointing. In a study we found that overall survival was 75% of those treated with High-Frequency Oscillatory Ventilation (HFOV) and only 40% of those treated by ECMO (1).

Now, a few years after, ECMO centers have increased fourfold. Units with well-established ECMO programs may have a lower threshold for ECMO. ECMO also necessitates high-risk transfers to specialized centers. Now cannulation in site, allows the stabilization and transfer to a facility with well-established ECMO programs. In a recent study in 2013, we showed that during the study period, 351 patients were admitted to the 3 ICU, 150 of them required mechanical ventilation, 26 HFOV, and 5 patients received ECMO, in them we documented an overall survival of 80%, with 5.5 days in ECMO (2). And a study of an ECMO transport program now reported an overall survival in the ECMO group of 64% (3).

Currently Chile has 8 centers with ECMO programs and in the rest of Latin America there are 10 centers with ECMO programs: 4 centers in Argentina, 3 in Brazil, 1 in Colombia, 1 in Peru and one center in Mexico (4). Still persist a controversy on the use of ECMO at countries with limited resources and now health authorities. Despite some evidence of it being cost-effective, authorities and experts are concerned if running the service in several nearby centers outside a pandemic context may lead to inadequate exposure, infrequent training opportunities, and questionable cost effectiveness. Centralizing ECMO services to ICUs with well-established ECMO programs may improve results and cost effectiveness. Especially when the actual requirement for ECMO outside the influenza pandemics itself is expected to be low.

We hope that these new ECMO referral centers, associated to a better network management, will impact positively on the survival of patients with respiratory or cardiac failure and increase the availability of this expensive therapy in the future to a greater number of patients in our countries.

References

4. Extracorporeal Life Support Organization (ELSO) registry report http://www.elso.med.umich.edu/Member.asp
The concept of extracorporeal Carbon dioxide removal, as opposed to the one of extracorporeal oxygenation, was introduced in 1976 by Kolobow and Gattinoni, following the failure of the NIH ECMO study to show any effect of extracorporeal membrane oxygenation on survival of the most severe hypoxemic acute respiratory failure. The basic concept put forward by these two investigators was that extracorporeal gas exchange could be of no benefit to the patients lung if not coupled to a lung protective ventilator strategy. They clearly accused high tidal volume high pressure ventilation as non conducive to lung healing, but rather to further damage an already diseased lung.

Exploiting the CO2 removal efficiency of the membrane lung appeared as the key to control lung ventilation, and hence avoid lung and systemic damage due to mechanical ventilation. This approach, pushed to its extremes, led to the experimental application of apneic oxygenation to successfully prevent infant respiratory distress in a model of premature birth in lambs. We then published the application of high flow (1.5 to 2.5 l/min) extracorporeal CO2 removal in adult ARDS, showing survival rates ranging from 100 to 55%. Since then extracorporeal CO2 removal has evolved to simpler and less invasive applications, aimed at preventing ventilator induced lung injury in ARDS patients in which overdistension and high pressures are present even with tidal volumes (TV) at 6 ml / KIg IBW. This result can be achieved at low blood flows (0.3 to 0.5 l/min), allowing a reduction of TV at levels between 3 and 4 ml/kg. A different but very effective approach is provided by a pumpless arteriovenous shunt at flows between 1.2 to 2 l/min.

Whichever the technique applied ECCO2R is potentially useful to:
- avoid intubation in acute and chronic patients
- extend the application and the success rate of noninvasive ventilation
- decrease the length of intubation and controlled mechanical ventilation
- help in decreasing the level of sedation by decreasing the length of intubation
- decrease the incidence of ventilator associated pneumonia, which in fact is intubation associated pneumonia.

The future of ECCO2R will be conditioned by the availability of simple, miniinvasive extracorporeal circulation procedures. Blood flow should be in the range of 200-300 ml/min, possibly with regional anticoagulation and with circuits lasting for at least a week rather than a single day.

To this end we should focus our attention on techniques aimed at removing the highest amount of CO2 from a minimal extracorporeal blood flow.
ECMO AS A BRIDGE TO LUNG TRANSPLANTATION

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Lung transplantation has increased rapidly over the last few decades and now considered an appropriate therapeutic option for end-stage lung diseases. Early survival after lung transplantation has improved, but median survival was still only 6 years. However, given the paucity of available donors, there is still significant mortality for patients on the waiting list.

Historically, use of extracorporeal membrane oxygenation (ECMO) as a bridge to lung transplantation (BTT) remains highly controversial given a high mortality rate, many complications, prolonged ICU and hospital stay, and prolonged physical rehabilitation.

However, last 10 years, with significant improvement in technologies, several single center studies have shown promising outcomes related to the use of ECMO as a bridging strategy although limited to retrospective. This success is secondary to the extensive experience and technological capabilities in managing the complexities associated with ECMO at high volume centers and shorter waiting times subsequently leading to a shorter pre-transplant ECMO duration and improved survival.

To bridge even sicker patients to transplant by mechanical ventilation alone may result in poor post-transplant survival. Therefore, it should be used not only to bridge but also to improve the patient’s clinical status prior to transplant. Taking the concept of awaking ECMO one step further progressed with pre-operative ECMO in bridged patients able to perform active rehabilitation. As larger studies are performed, a clearer picture as to the outcomes of ECMO use is emerging. And also, it should be planed to determine issues such as how the need for pre-transplant ECMO should weigh in to organ allocation, or what the appropriate indications and patient populations to bridge to lung transplantation.

Many centers now advocate the use of a multidisciplinary team in patients with ECMO while awaiting lung transplantation. The objectives are to improve the preoperative condition of the patient by enhancing physical strength and cardiovascular fitness and reducing the risk for posttransplant complications. Bridging patients to transplant requires continual evaluation of the patient’s physiology, response to intervention, and fitness for transplant. The goals of care and the parameters for discontinuation must be clearly established prior to initiating support.

This review briefly describes the evolution of ECMO use in lung transplantation and summarizes the available technology and current approaches to provide ECMO supports, and recent observational studies of ECMO use before and after lung transplantation, and reflect upon our own institutional experience with the use of ECMO in these difficult clinical situations.
MOBILE ECMO TEAM

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Centralization of advanced medical therapies improves outcomes; recently this was shown also for ECMO (1). ECMO is a complex and resource consuming intervention, which should preferable be done in specialized centers (2). In consequence, referral of patients with severe respiratory failure is meaningful. ARDS may worsen rapidly and may be accompanied by right heart failure, so that patients are too instable for transport and require transport on ECMO. The CESAR-trial showed improved outcome for ECMO patients in comparison to conventional treatment in severe respiratory failure. Referral on ECMO was not possible in this trial, and several patients died before or during transport of patients to Glenfield (3).

Arguably, the results may even have been more positive in favor of the ECMO group with the availability of mobile ECMO.

Mobile ECMO demands an experienced team, portable equipment and a fast transport system. While transport on ECMO in the past was a major maneuver requiring complex logistics (4), both transport and treatment have been revolutionized by the development of modern biocompatible miniaturized devices, often referred to as 2nd generation ECMO. For long distance transport the emphasis has to be laid on equipment, which is capable to deal with every conceivable complication. For shorter distance transport (< 250 km), often done by helicopter, speed is more important to arrive in time to stabilize the patient. The decision between greater speed and more extensive equipment will depend on the specific conditions each center has to face. Both in cardiogenic shock and in respiratory failure transport on ECMO is feasible.

Safe cannulation is of utmost importance in an external hospital; therefore, in respiratory failure jugular double-lumen cannulas should be used only, if the operator is very experienced, fluoroscopy is available, and conventional cannulation with two single cannulas is not possible. Ultrasound guided cannulation is mandatory. Adjustment of ventilation and sweep gas flow after implementation of ECMO is very important to avoid hypocapnia and respiratory alkalosis during transport.

The University Medical Center Regensburg accepted a total of 364 patients for ECMO referral since 2006. 12 patients died before arrival of the team, 6 after cannulation before transport without possibility to stabilize them, 25 were transported without ECMO (3 for failed cannulation). On transport two patients died, one due to pericardial tamponade, the other due to cannula failure. 100 cases of VA ECMO and 219 VV cases were successfully transported to Regensburg, the average transport distance being 125 km. Survival to discharge was 57 % in the former and 69 % in the latter.

In summary ECMO supported transport with modern devices is feasible, effective and safe with survival rates comparable to in-house ECMO. It should be offered by every ECMO center.
Literature


RAPID RESPONSE SYSTEM: THE IMPACT OF DELAYED ACTIVATION

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Rapid response systems have been introduced to deliver a timely high quality ICU-like intervention to the patients bedside, the rapid response team (RRT). Their goal is to ensure patient safety first and, if necessary, to escalate treatment. In order for the RRT to deliver such care rapidly and effectively, it is necessary for it to be activated in a timely manner. The activation component of the rapid response system (the afferent arm), however, is the most fragile component of the system and often fails to respond to signs of deterioration because of difficulties in recognizing such deterioration or because of logistic factors or because of anthropological factors or because of hierarchical factors. Such factors can lead to delays in the activation of the RRT. Such activation is relatively common and has now been studied in terms of its epidemiology. It is now clear that most RRT activations that have been preceded by physiological derangements or concerns about the patients well-being but where such activation has been delayed for >30 minutes put the patient at greater risk of adverse outcomes. In patients with an activation delay >30 minutes mortality is significantly increased in different physiological subgroups from respiratory distress, to tachycardia, to hypotension to changes in consciousness. These observations highlight the need to develop strong patient monitoring structures and education to rapid response in order to ensure patient safety.
RISK REDUCTION BY AUTOMATED ALARMING SYSTEMS

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Patient-ventilator dyssynchrony is common during mechanical ventilation. Poor interaction between the patient and the ventilator may decrease comfort, increase the intensive care unit stay, and might be associated with worse outcome. Dyssynchrony can occur during the triggering of the ventilator, the inspiration period after triggering, the transition from inspiration to expiration, and the expiratory phase. The most common dyssynchronies are delayed triggering, autotriggering, ineffective inspiratory efforts (which can occur at any point in the respiratory cycle), mismatch between patient’s and ventilator inspiratory time, and double triggering. Nowadays, the usual method to detect dyssynchronies is through observation of ventilator waveforms, although physicians’ performance is suboptimal and a number of events go undetected. Evaluation of patient-ventilator synchrony during the entire course of mechanical ventilation is technologically complex and has never been done. Studies evaluating short time periods show that a high index of dyssynchrony may increase the duration of mechanical ventilation. Better training and computerized systems that permit better synchronization of patients’ demands and ventilator outputs are necessary to improve patient-ventilator synchrony.
Many patients who are acutely ill may receive suboptimal care when changes in their status remain unrecognized or are inadequately treated on a general ward. Delays in ICU admission may result in further physiological deterioration, leading to prolongation of hospital stay, increased resource utilization, and poorer outcomes.

A hospital-wide team approach to the management of patients at risk of unexpected death and cardiac arrest, based on early recognition of deterioration and early resuscitation, has been developed to reduce the number of unexpected deaths, cardiac arrests, and unplanned ICU admissions. In response to these considerations, the concept of the rapid response system (RRS) has been developed. Many studies showed that early intervention in response to physiological instability might prevent further deterioration in many patients.

Although there are various models for activating an MET, the calling criteria in the afferent limb are almost always composed of similar vital signs. The MERIT study showed that in hospitals with an MET, only 30% of adverse events in patients that satisfied triggering criteria generated an MET response. Triggered by 24-hour electronic medical recording (EMR)-based screening criteria could be one of solutions.
CRITICAL CARE OUTREACH: ICU WITHOUT WALLS

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Intensive care units started as places that co-located severely ill patients for intensive nursing support. In the late 1950’s a critical care specialist was added to the team. As the trend to treat less ill patients outside of hospitals has continued the overall severity of illness of the hospitalized patients has increased calling into need providers with skills in such patients. These patients include those with high risk factors for decompensation as well as those that range from requiring telemetry through intermediate care to ICU-level support. Critical care specialists and teams designed to support patients across this spectrum are needed. In addition, ICU providers have taken on issues that can lead to critical illness in a risk mitigation approach. Furthermore, post-intensive care syndrome has been recognized and system to support and learn from patients and families that survive protracted critical illness are under way. The pre-ICU and post-ICU patients also might benefit from the involvement of critical care specialists. These expanding roles will be described and discussed with a focus at what the possibilities might be for organizational constructs and outcome assessments.
IMPLEMENTATION OF RAPID RESPONSE SYSTEM

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Introduction: Rapid Response System (RRS) is one of the main methods to improve inpatient care. However, because the verification systems are still insufficient and an educational system has not been established, it is difficult to implement said system. The situation was investigated at 253 institutions by the Japanese Society for Emergency Medicine (JSEM) in 2010. At the same time, the Japanese Society of Education for Physicians and Trainees in Intensive Care conducted RRS Workshops (RRS-WS) and Fundamental Critical Care Support (FCCS) as educational tools. Methods: We distributed surveillance questionnaires to 253 institutions, and had 82 participants in RRS-WS since December 2010 to April 2012 and 1,684 participants in FCCS since February 2010 to June 2011.

Results: Among the 253 institutions, only 40 percent of the institutions had a verification system. Moreover, more than half of the institutions do not have a proper educational system. On the other hand, the majority of participants for RRS-WS and FCCS obtained the proper education, and had a solid understanding. Comprehension was improved by providing abundant literature and didactic lectures that included topics from deployment to management. Educational objectives have included as follows: assess the need of the acutely and critically ill patients, identify appropriate diagnostic tests, respond to significant changes in patients, initiate management, and recognize the need for expert consultation. We have added a mock-practice session of response team briefing and debriefing. Therefore, the provided effective education would promote the deployment of RRS. As a result, RRS is gaining acceptance at many institutions and improving healthcare providers awareness on medical safety for inpatients nowadays. In Japan, multi-institution registration for RRS has been started and more than one thousand cases are accumulated in a database. Analysis result will absolutely promote the implementation of RRS.

Conclusion: Standardized educational courses which cover all components of RRS is useful to solve the issues and promotes the dissemination.
THE IMPACT OF RAPID RESPONSE TEAMS ON DO NOT RESUSCITATE ORDERS

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The advent of rapid response teams (RRTs) worldwide has increased the safety of acutely deteriorating patients in medical and surgical wards by decreasing the incidence of cardiac arrests. Multiple studies, however, have now shown that such teams are increasingly called to see patients who are deteriorating but, instead of requiring increased intervention, are more appropriately treated with a conservative approach which leads to the issuing to limitations of medical therapy orders. Such deteriorating patient typically have advanced comorbidities, are medical patients, have been in hospital for a prolonged period prior to the issuing of the RRT call, have been treated but have failed to improve and are in the older age group. In such patients, the RRT identifies that the focus of care should shift from escalation to decreased intensity and from advanced treatment to end-of-life care management. In practice, the RRT makes the diagnosis that the patient is not just acutely ill and deteriorating but rather that he/she is dying and should be treated as such. In such patients, the RRT can implement discussions with the parent unit, can initiate discussions with the family and can explain that escalation of care is unlikely to be of help to the patient. Referral to the hospital palliative care unit may become necessary. These decisions and conversations can be difficult and sometimes controversial but inevitably become necessary as hospitals are involved in the care of older and older patients with more and more comorbidities.
IMPROVING PERFORMANCE OF THE RAPID RESPONSE TEAM

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World Federation of Critical Care Nurses, Australia

Antecedent clinical indicators can be identified, measured, responded to early and treated appropriately to prevent deterioration of the hospital ward patient (1). If clinical staff are informed and educated to identify these antecedent measures it is possible that they can raise the alarm for help early, and before further deterioration occurs. In many hospitals Rapid Response Systems (RRS) are being formulated to ensure a systematic response mechanism is in place to respond rapidly to the deteriorating patient.

Medical Emergency Teams (MET) or Rapid Response Teams (RRT) are small teams of health professionals (usually doctors and nurses from critical care backgrounds) that can be called as soon as an antecedent measure is detected. Commonly used antecedent measures are pulse, blood pressure, respiratory rate, oxygen saturation, temperature, neurological state and other signs of deterioration in the patient’s overall well-being.

This presentation provides a case studies of the development of RRS and MET teams in a range of teaching hospitals that have been able to demonstrate immediate benefits from this approach to deteriorating patients. With each evolution of the system, the techniques and outcomes show improved sophistication, staff satisfaction and overall improvement in patient safety across the system. Variations to the RRS and MET structure are possible to suit the particular context and environment of each hospital, however some common principles remain standard in all (2).

A BUNDLE FOR TREATMENT AFTER CARDIAC ARREST: PROTECTIVE VENTILATION, TEMPERATURE CONTROL AND STABLE HEMODYNAMICS

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The mortality of postcardiac arrest patients is still as high as 50%, despite advancements in the diagnostic and therapeutic approaches. Recent evidence suggests that different therapeutic interventions might minimize progressive deterioration of the brain and other organs function. A bundle of treatment will be discussed and presented including: 1) therapeutic hypothermia for 12-24 hours; 2) mean arterial pressure ≥ 65-75 mmHg; 3) PaO2 and PCO2 between physiologic ranges; 4) protective mechanical ventilation with tidal volume of 6-8 mL/kg and low levels of positive end expiratory pressure; 5) monitoring of respiratory mechanics, extravascular lung water, hemodynamics, as well as non-invasive transcranial Doppler and intracranial pressure monitoring; and 6) others supportive care, i.e. blood sugar and seizures control.
THE NEW GUIDELINES TO COME: NEW EVIDENCES AND ITS IMPlications IN ADVANCED CARDIAC LIFE SUPPORT (ACLS)

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The American Heart Association and the European Resuscitation council will present 2015 CPR guidelines and emergency cardiac care based on systematic evidence evaluations. Big changes of 2015 guidelines as follows, First, they will suggest end-tidal CO2 (ETCO2) ≥ 10 mmHg, measured after the intubation or at 20 min of resuscitation predict return of spontaneous circulation (ROSC).

And ETCO2 ≥ 10 mmHg measured after the intubation or ETCO2 ≥ 20 mmHg at 20 min of resuscitation, may be increase chance of survival at discharge. Second, they will suggest using ECLS (cardiopulmonary bypass) as a rescue treatment when initial therapy is fail patient who cardiac arrest that occurs during percutaneous coronary interventions and out-of-hospital cardiac arrests. Third, ultrasound during CPR may be considered additional diagnostic tool to identify potentially reversible causes by stand ACLS protocol, Airway management, exhaled CO2 detection devices, and drug therapy and defibrillation energy during CPR are unchanged from 2010 guidance.
HOW TO IMPROVE THE QUALITY OF CPR

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Prompt delivery of cardiopulmonary resuscitation (CPR) is an essential treatment for sudden cardiac arrest (SCA), in the prehospital setting, among hospitalized patients, and in the critical care environment. A growing body of clinical evidence supports the concept that the quality of CPR is a crucial determinant of SCA outcome. That is, delivery of high quality compressions with adequate depth and rate, coupled with the minimization of compression pause time and minimization of hyperventilation, can greatly improve survival. In this lecture, I will discuss recent clinical studies that demonstrate the importance of CPR quality, and will also discuss practical approaches to improving the quality of resuscitation care. This will include the role of CPR-sensing defibrillators, team debriefing after resuscitation events, and the potential application of mechanical CPR devices. The role of physiologic sensing during CPR (for example, use of end-tidal CO2) will also be discussed. Clinical work from US, Europe and Asia will be included to demonstrate these principles.
THE FIFTH LINK IN THE ‘CHAIN OF SURVIVAL’ CONCEPT AFTER CARDIAC ARREST

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Out-of-hospital cardiac arrest (OHCA) affects approximately 300,000 people in the United States, 280,000 in Europe, and 100,000 in Japan each year. Previous studies reported that the survival rate of OHCA patients remained low. To overcome this low survival rate, the chain of survival concept was developed and incorporated into the International Liaison Committee on Resuscitation (ILCOR) and American Heart Association (AHA) guidelines in the 1990s as follows: (1) early access to emergency medical care; (2) early cardiopulmonary resuscitation (CPR); (3) early defibrillation; and (4) early advanced cardiac life support. The same chain of survival concept was used until the 2010 guidelines were published. The latest AHA guidelines, published in 2010, implement a fifth link, namely post-cardiac arrest care, in addition to the previous four links, as another critical link in the chain of survival concept. Post-cardiac arrest care includes the use of therapeutic hypothermia, percutaneous coronary intervention, and other advanced interventions to improve outcomes of patients following cardiac arrest. However, only limited evidence supports the implementation of the fifth link.

The Aizu Chain of Survival Concept Campaign, initiated on January 1, 2009, approximately two years before the release of 2010 AHA Guidelines, aimed to determine the effectiveness of this fifth link. After resuscitation, all eligible patients who achieved the return of spontaneous circulation were concentrated at a single post-resuscitation-skilled hospital where they received intensive care, including appropriate hemodynamic and respiratory management, therapeutic hypothermia, and percutaneous coronary intervention. The survival rate and the proportion of OHCA patients with a favorable neurological outcome improved significantly after implementation of the fifth link. This study provides evidence that implementation of the fifth link in the Chain of Survival is associated with significant and important improvements in survival and favorable neurologic outcome.

Several other recent studies also suggested the effect of post-resuscitation care, globally. Resuscitation experts have recently recommended the development and implementation of regional systems of care for cardiac arrest. In the guidelines, the initial four links of the Chain of Survival have been simplified in every revision. For example, for the first link, the guidelines now focus more on recognition of cardiac arrest. For the second link, hands-only CPR without rescue breathing is recommended. Look, Listen, and Feel has been removed from the algorithms for layperson CPR. For the third link, the defibrillation sequence has been reduced from three stacked shocks to a single shock. For the fourth link, several complicated medications were recommended in the Guidelines 2000, such as atropine, several antiarrhythmic drugs, and sodium bicarbonate for resuscitation. However, the fifth and final link cannot be simplified for non-specialists. We need an additional, different approach to counteract the post-cardiac arrest syndrome.
INDIVIDUALIZED ANTIBIOTIC DOSING IN ICU

Gavin Joynt

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Failing to optimize antibiotic dosing for critically ill patients can lead to worse outcomes. Consequences include toxicity from over dosage or inadequate bacterial eradication and emergence of resistance from under dosage 1,2. The pathophysiological changes of critical illness can be anticipated and include altered volume of distribution and variable hepatic and renal clearance. The effect of these changes on pharmacokinetic (PK) behavior can be extensive, and must be accounted for. Knowledge of the factors that affect PK and knowledge of correct pharmacodynamic (PD) targets allows better optimization of antibiotic dosage. When possible, it may be justified to use physiological data such as estimated volume of distribution in the critically ill, calculated or measured creatinine clearance, filter clearance (in patients receiving renal replacement therapy), and non-renal clearance data derived from critically ill patients to better anticipate dosing requirements 3. Software programs are emerging to assist clinical application of these principles to individualized dosing.

However the variability of these complex pathophysiological effects on ultimate blood and tissue concentrations is still not clearly delineated, and sometimes the patho-physiological data required for PK/PK calculation are unavailable. In such circumstances, rapid response time therapeutic drug monitoring (TDM) is a better alternative and may be associated with clinical benefits. Although not yet widely available, TDM is a promising method for guiding antibiotic dosing in the future 4. More studies comparing the clinical outcomes associated with individualized dosing techniques are necessary.
MULTI DRUG RESISTANT MICROORGANISMS

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Infections with multi-drug resistant (MDR) microorganisms are major problems in intensive care units (ICU) all over the world. ICUs face with extreme (XDR) and even pan-drug resistance (PDR) more and more often. On one hand, antibiotics should be started as early as possible especially in severe sepsis and severe infections such as ventilator-associated pneumonia (VAP) according to Surviving Sepsis Campaign guidelines or sepsis bundles, and timely and appropriate antibiotic use is a prerequisite for increased survival. On the other hand, antibiotic exposure or volume is a number one cause of development of antibiotic resistance. Therefore, early and more precise diagnosis of causative microorganisms are needed with antibiotic stewardship and multi-model prevention policies.

ICU acquired infections are seen in almost 20-30% of the critically-ill patients, although more than 50% of the patients were found to be infected in the one-day prospective point-prevalence EPIC-II (Extended Prevalence of Infection in Intensive Care) study. Infections due to MDR microorganisms increase mortality, length of stay, duration of mechanical ventilation and cost.

Among gram-positive microorganisms, the most important ones encountered in the ICU are methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE). In gram-negative microorganisms, the resistance is mainly encountered in Klebsiella pneumonia, Escherichia coli, Pseudomonas aeruginosa, Proteus, Enterobacter, Citrobacter and Acinetobacter species. Clostridium difficile is becoming more important worldwide, as well. In addition, resistance is a concern in fungi, too.

Four factors have been defined for emergence and spread of resistance: induction, selection, introduction and dissemination of resistant strains (Bonten and Mascini. Intensive Care Med 2003;29:1-2). Resistance can occur during antimicrobial treatment such as by mutation. Antimicrobial treatment causes selection of resistant strains, as well. Most patients have already been colonized before ICU admission and many healthcare workers are also carriers. In addition, poor infection control leads to dissemination of the MDR pathogens.

Although, ICUs are the main areas for MDR microorganisms, antimicrobial resistance has become an important issue beyond ICUs, such as community, nursing homes and other healthcare facilities. In addition, since patients are mostly colonized before admission to ICUs, infection control practices should start as soon as the patient is admitted to the ICU. According to Centers for Disease Control recommendations, strategies as a solution to combat with MDR microorganisms are prevention, diagnosis and treatment, and rational use of antibiotics. Antibiotic stewardship or the optimization of antibiotic usage for both therapy and prophylaxis, is certainly necessary in management. Stakeholders in this battle are not only the healthcare workers within the ICU itself, but efforts of all healthcare providers including hospital administrators, policy makers, and even patients are needed.
ANTIBIOTIC RESISTANCE - HOW DO WE MANAGE IT?

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The lecture will incorporate the following:

a. Current situation pertaining to antibiotic resistance
b. Key objectives to address antibiotic resistance
   a. To limit the emergence and spread of resistant pathogens (education, stewardship, regulation of use)
   b. Surveillance
c. Early rapid detection of resistant pathogens,
d. Vaccines programs
e. New vaccines and antibiotics
f. Modification of currently available antibiotics to overcome current resistance
g. Education
c. Role players: National policy makers, scientists, health care leaders, pharmaceutical companies, health insurance industry, agricultural industry, veterinarians and patients
d. Collaboration: national and internal
LUNG ULTRASOUND

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Critical ultrasound was defined in our 1993 publication as a loop associating one diagnosis with one immediate therapeutic decision. The inclusion of the lung, a vital organ, is part of critical ultrasound - providing a new definition of the priorities.

We use a 1992 (last update 2008), gray-scale unit, without Doppler, and a microconvex probe for lung, heart and whole body assessment in the critically ill. Simple machines work better than up-to-date ones.

Lung ultrasound requires the mastery of no more than ten signs: the bat sign (pleural line), lung sliding (yielding seashore sign), the A-line (horizontal artifact), the quad sign and sinusoid sign indicating pleural effusion, the fractal and tissue-like sign indicating lung consolidation, the B-line and lung rockets (indicating interstitial syndrome), abolished lung sliding with the stratosphere sign, suggesting pneumothorax, and the lung point, indicating pneumothorax. Some other signs are used for more sophisticated uses (the lung pulse, the dynamic air bronchogram, distinguishing atelectasis from pneumonia for instance...). All these disorders were assessed using CT as gold standard with sensitivity and specificity ranging from 90 to 100%, allowing to consider ultrasound as a reasonable bedside gold standard in the critically ill.

The BLUE-protocol1 is a fast protocol (less than 3 minutes), allowing immediate diagnosis of acute respiratory failure. It associates signs with locations. It includes a venous analysis (done in the case of normal anterior lung surface), different from traditional approaches, with mainly particular emphasis at calf areas, and use of nonvascular probe. Pulmonary edema, pulmonary embolism, pneumonia, COPD/asthma (considered together) and pneumothorax yield specific profiles. Pulmonary edema e.g. yields anterior lung rockets associated with lung sliding, making the “B-profile”. There are seven other profiles, quite specific to each disease.

Among developments of the BLUE-protocol, the FALLS-protocol2 is used in acute circulatory failure, provides a direct parameter of clinical volemia, by analyzing lung artifacts. The FALLS-protocol considers the apparition of B-lines, schematically, as the endpoint for fluid therapy. This allows to simplify “Echo”, which can be reduced to simple real-time analysis (right ventricle dilatation, pericardial effusion).

Lung ultrasound is used first in the SESAME-protocol, our protocol for cardiac arrest where heart comes 5th (lung then DVT then free blood then pericardium, then heart), using one universal probe.

Interventional ultrasound (mainly, here, thoracocentesis) provides maximal safety and can change patient management. Referrals to CT can be postponed (ARDS, trauma). Irradiation is decreased. All these applications can be performed in trauma, ICU, remote areas, and neonates (the signs being the same as in the adult). The CEURF makes since 1990 personnalized training of intensivists to the BLUE-protocol at the bedside of the critically ill.

Lung ultrasound is part of a concept called holistic ultrasound: several elements, apparently distinct, are joined together (lung artifacts, the one probe philosophy, a non laptop machine a.m.o.), for making a whole which allows the practice of a visual medicine.
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LUNG ULTRASOUND IN ARDS

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Transthoracic lung ultrasound (LUS) is a noninvasive, easily repeatable, and reproducible tool that does not require intra-hospital transfer of patients outside the Intensive Care Unit (ICU). It allows the bedside diagnosis of alveolar-interstitial syndrome, lung consolidation, pleural effusion and pneumothorax in critically ill patients. Recently, LUS has become an alternative method for early diagnosis of Acute Respiratory Distress Syndrome (ARDS) and bedside assessment of lung aeration during this syndrome. The heterogeneous distribution of the ultrasound patterns including well-separated or coalescent B-lines, spared areas together with the presence of posterior lung consolidations with bronchograms is typical of Acute Lung Injury (ALI) or ARDS and allows its early distinction from acute cardiogenic pulmonary edema. Moreover, several studies have showed that LUS using scores based on number of B-lines can monitor extension of pulmonary edema, the amount of extravascular lung water and the corresponding decrease in lung aeration. It has been demonstrated that ultrasound scores exclusively based on the number of B-lines are linearly correlated to decrease in lung aeration. This allows to quantify lung aeration changes during ARDS both as consequence of the disease and as the effect of different levels of positive end-expiratory pressure (PEEP). The value of LUS for assessing PEEP-induced reaeration of lung consolidation has been firstly demonstrated evaluating the coalescent B-lines after PEEP, indicating partial reaeration of the left lower lobe.

Using this method in patients with ALI/ARDS, it was monitored the daily time-dependent lung reaeration by measuring the decrease of consolidated regions and the increase in lung aeration resulting from prone positioning. Significant correlations were also found between decrease in consolidated areas and improvement of oxygenation. Although most of the studies were limited to left or right dependent lung regions, the whole lung should be examined in order to estimate the PEEP-induced lung recruitment. In fact, PEEP-induced lung recruitment has been adequately estimated with LUS using a reaeration score taking into account not only consolidated lung regions but also lung regions with moderate and severe loss of inflation. Although a high correlation was found between LUS reaeration score and Computed Tomography (CT) reaeration, however, studies using CT of the whole lung as gold standard are required to evaluate ability of LUS to reliably estimate PEEP-induced lung recruitment.

LUS not only helps to establish an early diagnosis in ARDS patients but also to plan specific therapeutic action, for example when a pneumothorax occurs.

In conclusion, LUS significantly reduced the number of chest X-rays and CT scans performed and the risk of intra-hospital transport to the radiological department. However, LUS is of limited usefulness in obese patients and in the presence of subcutaneous emphysema or large thoracic dressings and it requires an adequate period of training. Moreover, LUS cannot detect PEEP-induced lung hyperinflation while CT data of the whole lung have shown that PEEP produces not only end expiratory reaeration of non aerated parts of the lung (recruitment), but also simultaneous end-expiratory hyperinflation of aerated pulmonary areas in patients with focal ARDS.
ULTRASOUND IN ANAESTHESIOLOGY & CRITICAL CARE MEDICINE; PROCEDURAL AND DIAGNOSTIC APPLICATION

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The desire to penetrate the skin's surface visually has been a long-standing physician's wish; however, it is not a static image but rather a dynamic portrayal of physiologic function that has eluded bedside analysis and capability. Today, portable ultrasound units afford this capability and provide physicians the ability to interrogate and see target organs and evaluate current function and potential reserve in real time. The earliest and most highly developed analyses involve cardiac function, but newer capabilities exist to evaluate cerebral blood flow, lung function, renal perfusion, intracranial pressure abnormalities, peripheral vascular integrity, and additional examinations. The realization that physicians can see and assess physiologic function in real time is a tipping point in critical care; the reality is if intensivists are not embracing the technology today, their professional development will be limited and their ability to care for their patients compromised.

Lumb P. Preface. Critical Care Ultrasound, Elsevier 2014

The concept of a holistic, non-invasive, real-time evaluation of patient well-being (or lack thereof) first struck imagination in the 1960s television series Star Trek when bones made brilliant diagnoses with a Tricorder.

Similar in external appearance to the sciences model, the medical tricorder is designed and programmed to be an effective diagnostic tool in situations (such as in field treatment) where more extensive or specialized equipment is unavailable. In practice a small sensor/computer/recorder (tri-function recorder) with internal power source, drive memory and logic banks, the medical tricorder acts much as the processing section of the sickbay diagnostic scanner; receiving and interpreting sensor signals of a patient's condition, and converting them into an audiovisual readout.

Star Fleet Medical Reference Manual; The Medical Tricorder p.150; Eileen Palestine, Editor. 1977 (Copyright Paramount Pictures) ISBN 0-345-27473

This discussion will focus on newer techniques in Critical Care that incorporate the use of bedside ultrasound as a routine management tool in the daily management of the critically ill patient. While the most frequent examinations may focus on the cardiovascular and respiratory systems, nonetheless, an ultrasound examination that incorporates additional parameters to evaluate volume status, abdominal pathologies, peripheral vascular integrity and guide clinicians in invasive procedures should be considered routine practice and, as such should attain prominence in the critical care curriculum.

It is important to recognize that not every examination utilizes all available ultrasound windows and techniques; rather the current approach to Critical Care Ultrasound (CCU) should be patient specific and focused on the primary areas of diagnostic concern. This presentation will focus on the available CCU methodologies and provide insight into the appropriate examinations specific to physiologic pathology (conditions) or organs systems at risk.
New Techniques in Functional Lung Imaging

CT SCAN IN ARDS: IS IT REALLY NECESSARY?

Davide Chiumello
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Lung Computed Tomography (CT) has changed the understanding and management of patients with Acute Respiratory Distress Syndrome (ARDS).

CT scan has allowed a morphological description of ARDS that includes the recognition of normally aerated lung, poorly inflated areas, characterized by increased density, with steel recognizable vessels (ground-glass opacifications) and not inflated areas with increased density and no recognizable vessels (consolidation). CT scan revealed a not homogeneous disease where the normally aerated lung tissue, localized in the nondependent lung regions, was markedly reduced leading to the concept of baby lung. Moreover the strict correlation between CT density and lung density has allowed to compute for any voxel of lung CT image the percentage of air and of lung tissue by the use of quantitative analysis and identify the loss of aeration in the dependent zones and the redistribution of lung densities with prone position that is the rationale of the sponge model.

The CT quantitative analysis has permitted to target tidal volume to the actual open portion of the lung by preventing the development of ventilator lung injury.

Consequently, we can quantify lung recruitment by measuring how much not aerated tissue becomes aerated by the use of two CT scans at different airway pressure. The quantification of lung recruitability is a prerequisite for a rationale setting of positive end-expiratory pressure (PEEP) to prevent the intratidal opening and closing and the consequent regional stress and strain in patients with high lung recruitability. Moreover, CT scan is a unique tool to differentiate between recruitment and hyperinflation because high levels of PEEP in patients with low lung recruitability can lead to overdistention of regions that are already aerated without opening the collapsed tissue.

CT quantitative analysis provides also the possibility to quantify the pressure (weight) transmitted to the dependent parenchyma along with the sterno-vertebral axis that is the superimposed pressure. This can be useful to set the PEEP level that can counteract this superimposed pressure to keep the lung open obtaining an homogeneous distribution of ventilation.

Finally, it has been demonstrated the CT lung morphology of the early ARDS can predict long-term prognosis in fact findings of early fibrosis are a strong independent predictor of mortality, while a pure consolidation pattern is associated to better survival.

The benefits of CT scan should be weighted with the risks associated with transporting patient outside the intensive care unit and with the radiation exposure. Moreover, the quantitative analysis needs dedicated software and a manual delineation of the lung that takes up to 6 hours. Recently it has been demonstrated that doses reduction strategies do not affect the accuracy of quantitative and visual analysis results and that the visual analysis of CT lung image is accurate in detecting lung recruitability.

In conclusion, CT scan remains the reference method to guide a rationale ventilation strategy in ARDS patients thank to the measurement of lung recruitability, alveolar collapse, lung hyperinflation and of the superimposed pressure, because no other imaging technique provides similar information.
PET IMAGING OF VENTILATOR-INDUCED AND ACUTE LUNG INJURY

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PET is increasingly used to study the pathophysiology of ARDS and ventilator-induced lung injury (VILI) in the intensive care unit and in experimental models. Two strengths of PET are its versatility and the quantitative measurements it affords: Depending on the specific isotopes and techniques employed, PET can quantify regional perfusion, ventilation, aeration, lung vascular permeability and edema, metabolic activity of inflammatory cells, enzyme activity, and, more recently, pulmonary gene expression.

1) PET imaging of regional lung function in ARDS and VILI: The isotopes most frequently used for this purpose are: 15-oxygen-labeled water to measure regional perfusion and lung water; 13-nitrogen dissolved in saline solution and injected intravenously to measure regional perfusion, shunt and ventilation of perfused alveoli (13-nitrogen can also be administered by inhalation to measure regional aeration and ventilation); 11-carbon monoxide to derive extravascular lung water; and 68-gallium-transferrin or 11-carbon-methylalbumin, to measure vascular permeability.

The value of functional pulmonary PET imaging is best appreciated by analyzing the incremental insights it provided compared with CT. For example, CT has shown that, in patients with ARDS, the loss of pulmonary aeration is heterogeneous: normally aerated lung coexists with derecruited lung, predominant in dependent regions. However, PET has demonstrated that the increase in pulmonary permeability is uniform throughout the ARDS lung, without a ventro-dorsal gradient, indicating that even areas of lung that have normal aeration are in fact affected by the disease process. Furthermore, PET measurements of regional perfusion have shown an inverse relationship between the fraction of pulmonary blood flow to dependent lung regions and the PaO2/FiO2 ratio of the subject. This finding implies that subjects with the same amount and distribution of derecruitment (i.e., with the same clinical CT or chest X-ray picture) can have markedly different PaO2, and hence clinical severity of ARDS, depending on the extent to which their perfusion redistributes away from dependent edematous regions. Combined PET measurements of perfusion and shunt have also identified redistribution of perfusion toward derecruited regions as the mechanism for the paradoxical worsening of oxygenation that is sometimes observed with PEEP or recruitment maneuvers.

2) PET imaging of inflammatory cell activity: Because activated inflammatory cells, in particular neutrophils, rely heavily on glycolysis as energy source, PET with 2-[18F]fluoro-2-deoxy-D-glucose ([18F]FDG) has been used to measure regional neutrophil metabolic activation in ARDS and VILI. Studies have shown that [18F]FDG uptake of the normally aerated portion of the ARDS lung is directly related to plateau airway pressure, again indicating that this portion of the lung may be inflamed and particularly vulnerable to VILI. Subsequent experiments have demonstrated that [18F]FDG uptake is proportional to regional tidal strain and that inflammatory stimuli such as endotoxin increase the susceptibility of the lung to a given strain, pointing to a deleterious synergism between such stimuli and VILI.
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IMAGING STRAIN AND INFLAMMATION IN EARLY LUNG INJURY AND ARDS

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Whereas mechanical ventilation is a life saving intervention for intensive care and surgical patients, it may in itself produce lung injury. This injury is produced by the different forms of mechanical stress and strain produced in the lungs due to the volumes/pressures applied by the mechanical ventilator. This is particularly relevant in heterogeneously expanded lungs such as those of humans, when concentration of mechanical forces could further locally amplify the global pressures applied. Imaging methods are particularly helpful in understanding such processes since they allow for noninvasive and invivo quantification of the structural, functional and inflammatory changes resulting from lung injury and mechanical ventilation.

The lecture will address the mechanical concepts of stress and strain, the pathophysiology of the production of lung strain, and the relationship of these strains with lung inflammation. Methods to quantify lung strain and lung inflammation (neutrophilic inflammation) using Positron Emission Tomography (PET) will be described. Applications of these methods to study the processes of lung inflammation in experimental models of normal and injured lungs will be discussed. Types of lung injury addressed will include surfactant depletion, endotoxemia, and ventilator-induced lung injury. Information obtained in these studies will be related to the understanding of lung physiology in clinical conditions and the potential choice of management strategies.
ELECTRONIC IMPEDANCE TOMOGRAPHY: PRINCIPLES AND CLINICAL APPLICATION

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Mechanical stress alters lung physiology and induces local inflammatory responses. Mechanical ventilation can initiate ventilator-associated lung injury (VALI) and contribute to multiple organ dysfunction through triggering or exacerbating inflammatory responses in the lungs and spreading localized inflammation to the systemic circulation. Uneven intrapulmonary gas distribution can increase regional stress and lead to develop VALI, especially in the non-homogeneous lungs, even though lung protective strategy with limiting both tidal volume and plateau pressure is carried out. Therefore, regional ventilation monitoring would be beneficial to reduce VALI.

Electrical impedance tomography (EIT) is a clinically available noninvasive technique that provides dynamic tidal images of gas distribution at the patients bedside. Its measurement principle is the creation of two-dimensional transverse single-slice images based on changes in impedance distribution originating from mechanical ventilation.

Studies have reported that EIT provides useful information such as lung recruitment, PEEP adjustment, lung volume estimation, and homogeneity of gas distribution. It is suggested EIT-guided mechanical ventilation provides tailor-made lung protection.
PERIOPERATIVE RESPIRATORY EVALUATION AND CARE

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A number of patient factors have been shown to increase the risk of postoperative respiratory complications following major surgery, including: COPD, age over 60 year and greater ASA grade. Procedure-related risk factors includes surgical site, duration of surgery, anesthetic technique, and emergency surgery. While good evidence supports general anesthesia as a risk factor on the basis of adjusted observational data, randomized, controlled trials have not consistently reported an effect of anesthetic type on postoperative pulmonary complication rates. The most common problem is atelectasis.

The task of preoperative PFT is to identify patients at increased risk for perioperative complications. However, PFT is not routinely indicated for assessment of patients prior to major non-thoracic surgery. Medical therapy is often initiated to optimize the pulmonary function before surgery. PFT is also indicated in patients with unexplained dyspnea to differentiate cardiac from primary lung pathology. Spirometry with flow volume loops assesses the mechanical properties of the respiratory system by measuring expiratory volumes and flow rates. The flow volume loops evaluate the presence of any major airway obstruction. Cardiopulmonary exercise testing (CPET) is an objective method of assessing the response of the heart, lungs and musculoskeletal system to incremental exercise. It relies on breath-by-breath analysis of carbon dioxide production and oxygen consumption. Lung resection surgery is associated with marked reductions in maximal expiratory force, vital capacity (VC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow rate (PEFR). Evidence-based guidelines for lung resection uses the values of FEV1, Diffusion capacity (DLCO), Predicted postoperative lung volumes and preoperative VO2 to evaluate the risk and mortality.

The value of preoperative testing to estimate pulmonary risk is perhaps the most controversial area in the field of preoperative pulmonary evaluation. While some reports have suggested that certain tests, such as spirometry and albumin level, identify a subset of high-risk patients, few studies have systematically compared the incremental risk attributable to abnormal preoperative testing with that obtained by history and physical examination. While spirometry may provide some risk stratification, most patients identified as high risk by spirometry can be identified equally well by clinical evaluation. Evidence is insufficient to determine whether spirometry provides incremental value as a tool to estimate postoperative pulmonary complication risk. The evidence does not support the use of routine spirometry to stratify risk before non-cardiothoracic surgery.

Recent evidence has shown that postoperative pulmonary and cardiac complications are equally prevalent and clinically important in morbidity, mortality, and length of stay. While clinicians have used preoperative cardiac indices for decades, recent efforts have developed perioperative pulmonary risk indices such as multifactorial postoperative respiratory failure index and postoperative pneumonia index. These indices might allow clinicians to reconsider the indications for surgery in a high-risk patient and suggest patients who will most benefit from postoperative pulmonary complications.
References

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Venous thromboembolism (VTE) is a common and often under-recognized entity. It remains the most common preventable cause of hospital death. Of note, it exceeds substantially, the total number of deaths from all hospital-acquired infections.

This is a state-of-the-art 2015 talk looking at a host of aspects relating and pertinent to VTE in the critically ill patient.

The talk will deal with all that is new and relevant in a practical fashion, and covers a variety of elements including fascinating facts, important practice pearls, new nuances and advances, guidelines, and controversial issues & challenges, amongst others, as well as offering evidence-based practical direction for all.

It is essential for everyone involved in critical care practice to have a thorough understanding of this often neglected but enormously relevant aspect of critical care.
CARDIAC COMPLICATIONS: PERI-OPERATIVE BETA-BLOCKER

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Adverse cardiovascular events such as myocardial infarction and unstable angina are the leading causes of death after surgery. Perioperative cardiac events can herald further complications and dramatically increasing hospital length of stay. Most events occur within the first few days after surgery, particularly the first 48 hours, when the effects of anesthetics, pain, fluid shifts, and physiologic derangements are greatest. Factors that may trigger acute occlusion in the perioperative period include abrupt changes in sympathetic tone, increased levels of cortisol and catecholamines, and tissue hypoxia. Other potential factors triggered by the stress of surgery include coagulation factors such as alterations in platelet function; inflammatory factors such as TNF alpha, interleukin 1 & 6, C-reactive protein and metabolism of FFA. β-blockers have several effects that may, protect against cardiac events in the peri-operative period. They reduce myocardial oxygen demand by reducing the force of contraction, heart rate, and they increase the duration of diastole, which improves myocardial perfusion. They have anti-arrhythmic properties and they may limit free radical production, metalloproteinase activity, and myocardial plaque inflammation. The systemic inflammatory response associated with major surgery is well described and impacts on outcome in the perioperative period. For patients undergoing noncardiac surgery the cardiovascular benefit of perioperative β-blockers has been the focus of debate for nearly two decades. In recent times conflicting results of studies that have shown both protective and harmful effects of β-blockers. A recent meta-analysis by comprising of 10529 patients revealed an increased risk of 30-day mortality among patients administered a β-blocker. In a major trial the PeriOperative ISchemic Evaluation (POISE) trial showed that in 8351 patients with IHD who underwent noncardiac surgery, those administered to 200 mg of ER metoprolol had an increase in 30-day mortality. However in a retrospective cohort of 37805 from the Veterans Affairs medical centers showed that patients undergoing noncardiac surgery who received β-blockers had a lower 30-day mortality. The Danish National Patient Registry looked at cardiovascular events and mortality in 28263 patients with IHD undergoing noncardiac surgery. In this dataset the use of β-blockers was not linked with a reduction of major adverse cardiovascular events or overall mortality. In a subgroup analyses patients with a diagnosis of heart failure showed a significant reduction in the risk of major adverse cardiovascular events and all-cause mortality that was not seen in patients without heart failure. (P < .001). Protective effect of β-blockers in patients with recent MI (defined as <2 years), was not evident in patients with more distant MI or no history of MI (P < .02). The role of β-blockers in reducing the risk of major adverse cardiac events in high-risk patients undergoing non-cardiac surgery is unclear and fundamental questions remain unanswered. The timing and dose of intervention, the optimal selection of drugs based on pharmacodynamics, the appropriate outcomes to be measured and, not least, the population most likely to benefit from treatment remain important factors that can only be answered by a new large well-conducted randomised control trial.
PULMONARY COMPLICATIONS: LUNG-PROTECTIVE VENTILATION FOR THE SURGICAL PATIENTS

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Patterns of mechanical ventilation that are characterized by large tidal volumes (> 8 ml/kg predicted body weight) or high airway pressures have been shown to worsen lung injury and outcome of patients with ARDS. Accordingly, the limitation of tidal volumes and the use of positive end expiratory pressure (PEEP) to reduce lung heterogeneity in patients with acute respiratory failure have been well accepted. Whether such lung protective ventilator strategies can prevent or minimize the occurrence of complications in patients at risk of respiratory failure in the perioperative period is less clear. Animal studies demonstrate that mechanical ventilation can injure the normal lung. In addition, current clinical evidence suggests that larger tidal volumes applied intraoperatively to high risk patients, such as those undergoing pulmonary resection or major abdominal surgery, are associated with a greater likelihood of postoperative respiratory failure and pulmonary complications. Intraoperative atelectasis is also common in the perioperative period, and can increase mechanical heterogeneity of the lung. This may make the lung more susceptible to ventilatory trauma. Lung derecruitment may be treated by the use of PEEP or recruitment maneuvers, but the level of PEEP required and extent of recruitment maneuvers remain unclear and probably should be individualized. Nevertheless, it appears reasonable to use some level of PEEP and lung expansion techniques in the perioperative period. While, adoption of such perioperative protective ventilatory techniques has been slow, it is reasonable to recommend their application in high risk patients. Current practice at the University of Cincinnati includes the use of an intraoperative tidal volume of to 6 to 8 ml/kg predicted body weight (500 to 550 ml TV for 70 kg patient), a minimum of 5 cm H2O PEEP, and a respiratory rate set to achieve an appropriate PETCO2. Adoption of these techniques has been improved by the use of educational guidelines and changes in the default settings of anesthesia machines in the operating room.
PERI-OPERATIVE GOAL-DIRECTED FLUID THERAPY

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The human and financial cost of post-operative mortality and morbidity is highly significant, and is potentially avoidable. Patients who suffer from post-operative complications are also at risk of long-term morbidity, however these patients make up only a small proportion of total surgical cases. Identification of patients who are at greater risk of post-operative complications is crucial, as therapeutic measures aimed at this specific group of patients may reduce morbidity and mortality.

It is estimated that 12.5% of all surgical procedures account for 80% of post-operative deaths, yet not more than 15% of these patients are admitted to critical care units after surgery. Complications following surgery can be related to a number of factors that include the post operative physiological derangement, the co-morbid burden and the age of the patient, the type of procedure performed and the urgency in which the procedure was undertaken. Surgery is associated with a systemic inflammatory response and an associated increase in oxygen demand. An increase in oxygen delivery and tissue oxygen extraction may meet this increase in oxygen demand. Failure to do so can result in anaerobic metabolism, cellular dysfunction, and ultimately organ failure. Surgical procedures that cause a significant increase in peri-operative oxygen demand, such as major intra-abdominal surgery, are therefore high-risk.

Patients who are unable to increase their global oxygen delivery or extraction to meet the demands of major surgery are at greater risk of post-operative complications. Shoemaker demonstrated that the haemodynamic responses of survivors and non-survivors of high-risk surgery were different. Non-survivors of high-risk surgery had significantly lower oxygen delivery index (DO2I) than survivors, and were therefore less likely to meet the increased metabolic demand. The cohort of patients who achieved a median post-operative DO2I of greater than 600ml/min/m², cardiac index of greater than 4.5l/min/m², and an oxygen consumption of greater than 170ml/min/m² were more likely to survive. By augmenting DO2I with a combination of intravenous fluids and inotropes, guided by pulmonary artery catheter monitoring, the post-operative mortality of high-risk patients was reduced from 33% to 4%. Subsequent studies have also shown that peri-operative goal-directed therapy (GDT) aimed at matching this increase in need for oxygen to a greater supply reduces post-operative mortality and morbidity.

This lecture will discuss the rates and causes of surgical complications and then provide an update on the evidence behind goal directed haemodynamic interventions in order to improve outcomes.
TRANSFUSION TRIGGER IN PERIOPERATIVE SURGICAL PATIENTS

Mihae Yu
University of Hawai'i School of Medicine & The Queen’s Medical Center, United States

An area of controversy is the end point of red cell transfusion. Two problems currently exist: 1) using hemoglobin (Hb) or hematocrit (Hct) to determine transfusion endpoint since both are surrogate markers of red cell volume, and 2) determining the endpoint of red cell transfusion, i.e. adequate tissue oxygenation states. Anemia is well tolerated if the patient is euvelemic (has high plasma volume to compensate for low red cell volume), and if cardiac output can rise to compensate for low red cell volume in order to maintain adequate oxygen delivery. Therefore, an optimum hemoglobin cannot be one numeric value, but is based on the patient’s disease, co-morbidity (especially cardiac function), and where in the course of illness the patient is.

A normal hemoglobin is 13-15 g/dL, and yet there has been a blind reluctance to give blood to critically ill patients due to the side effects of stored blood. Better Tissue perfusion monitors may guide red cell transfusions rather than a goal of one hematocrit value. Using hemoglobin/hct as a marker of anemia may not be valid since it may not reflect the true red cell volume. A 30-40% deficit in RBCV is possible with a Hct >30% due to a combination of low red cell volume and low plasma volume. The patient may suffer from anemic hypoxia, which is unrecognized by the routine clinical parameters, unless there is monitoring of tissue perfusion. The bedside measurement of blood volume has been simplified by a semi-automated technique for measuring circulating blood volume (BVA-100, Daxor, NY, NY) using I-131 tagged albumin. This allows for measurement of plasma volume, red cell volume, and total circulating blood volume. Measurement of red cell volume prevents misleading information from using a hematocrit value to guide red cell transfusion such as from “hemoconcentration” and “hemodilution”. Studies comparing red cell volume to hemoglobin/hct values have shown a significant deviation from red cell volumes due to changes in plasma volume in the critically ill patients. Therefore, the current transfusion guidelines and recommendations have very few level 1 evidence. What is clear is that not one value will be suitable for all patients. The solution should be to find safer methods of restoring red cell volume, rather than to abstain from giving blood.
INTESTINAL INTEGRITY IN SEPSIS-CELLULAR AND MOLECULAR MECHANISMS

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The gut is commonly referred to as the motor of critical illness. The gut contains an epithelium the size of a badminton court, a large and complex immune system and greater than 100 trillion microorganisms. Together, the elements of the gut work together to help maintain health. Under basal conditions, proliferation and cell loss are balanced in the gut, which renews itself every five days. However, in critical illness each component of the gut is dysregulated. Following a septic insult, gut epithelial apoptosis is increased while proliferation is decreased. Simultaneously, enterocyte migration is slowed and villus length is decreased. Rearrangements in the tight junction lead to increased intestinal permeability. This lecture will focus on molecular and cellular insights into how the gut is injured in preclinical models of sepsis and possible therapeutic approaches designed to maintain gut integrity and improve outcome in sepsis.
THE ROLE OF THE CENTRAL NERVOUS SYSTEM IN THE PATHOGENESIS OF SEPSIS

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Sepsis is a syndrome of disordered/dysregulated inflammation. Normal inflammation is characterized by a series of tightly regulated, carefully orchestrated activities that limit both excessive and inadequate responses and assure that organ function is coupled to maximize efficacy. In sepsis this coordination is lost and organ function is not coupled. Communication between tissues and organ systems is mediated by three complementary and interlinked response systems: the humoral system, where white cells transport information from tissue to tissue; the endocrine system, where organs are connected by the activity of substances secreted into the circulation; and the central nervous system (CNS), where information in one tissue is transmitted via ascending electrical impulses to the brain, integrated, and transmitted to other tissues via descending electrical impulses. Sepsis-induced abnormalities in the humoral and endocrine systems have been studied extensively. In contrast, little is known about how CNS dysfunction contributes to the dysregulation of inflammation. In this talk we will examine recent data on how the CNS modulates normal inflammation and how this process is altered in sepsis.
MONITORING THE MICROCIRCULATION TO GUIDE RESUSCITATION

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Many studies demonstrated that microcirculatory perfusion is altered in critically ill patients, and especially in sepsis. These alterations are characterized by heterogeneity of perfusion with capillaries with stop flow in close vicinity to well perfused capillaries. Different mechanisms have been implicated in the development of these alterations including loss of communication between microvascular segments, impaired endothelial vasoreactivity, alterations in red and white blood cells rheology, alteration in endothelial glycocalyx, platelet aggregation and microthrombosis. Alterations in microvascular endothelial function are also associated with activation of coagulation and inflammation, reactive oxygen species generation and increased permeability.

The presence of stop flow capillaries favours development of zones of tissue hypoxia, even though total perfusion to the organ is preserved and SvO2 is increased.

How to manipulate the microcirculation? Heterogeneity in perfusion is a crucial problem, leading to inadequate matching of flow to metabolism. Increasing flow without recruiting the microcirculation is thus ineffective. Fluids can improve the microcirculation, at least at the early stages, but these effects are blunted at later stages. Interestingly, fluids improved organ dysfunction only in some patients, and these were characterized as having the most altered microcirculation before fluid infusion. Monitoring the microcirculation may thus help to identify the patients who benefit most from supplemental fluid administration. Dobutamine may also increase microvascular perfusion, but this effect was somewhat variable and could not be predicted by the monitoring of systemic hemodynamics. Interestingly, the patients who improved the most their microcirculation also had the most important decrease in blood lactate levels. Vasopressor agents, when used to correct severe hypotension, improve the microcirculation, probably by an indirect effect related to the restoration of total organ perfusion. When higher targets of perfusion pressure are achieved, then variable and unpredictable effects have been observed, with impairment in some patients and improvement in others. When perfusion pressure is preserved, the use of vasodilatory agents has been proposed. After initial enthusiasm raised by a miniseries of 8 patients in septic shock demonstrating a marked improvement in microvascular perfusion in response to nitroglycerin administration, other trials failed to reproduce these preliminary results. Similar disappointing results have been observed with inhaled nitric oxide and with angiotensin converting enzyme inhibitors. At this stage there is insufficient evidence to support the use of non-selective vasodilatory agents. Indeed, due to their lack of selectivity, these agents can also dilate already perfused vessels and lead to a steal phenomenon. Promising results have been observed with agents that can selectively modulate endothelial nitric oxide synthase, leading to vasodilation only in the non perfused area. Vitamin c has consistently been shown to improve the microcirculation, and this effect was mediated by endothelial nitric oxide synthase. Tetrahydrobiopterin, an essential cofactor of endothelial nitric oxide synthase, was also shown to improve not only microvascular perfusion but also endothelial permeability. These results are very promising results but should be reproduced in larger trials in humans.
ECHOCARDIOGRAPHY IN THE MANAGEMENT OF SEVERE PULMONARY EMBOLUS

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It is calculated that 25-50% of the pulmonary artery has to be obstructed before causing hemodynamic compromise. The pathological effects extend beyond merely obstructing the artery with humoral and reflex vasoconstriction, systemic nervous system activation and often an inability of the right ventricle to cope with the sudden increase in pulmonary vascular resistance. Determining clot burden by scanning appears to be less important than identifying the hemodynamic consequence of an occlusion. Right ventricular dysfunction is readily measured by echocardiography and therefore has become a major tool in risk management of pulmonary embolus.

Traditionally terms such as massive and sub massive pulmonary embolus have been used but terms related directly to mortality appear to be more helpful. Initial risk stratification can be clinically based and where shock or hypotension exists it can be regarded as high risk, and low risk in their absence. Echocardiography assists in quantifying risk, with addition information by serum cardiac biomarkers adding to the accuracy of the prognosis. In the high risk group an echocardiogram is very important as the absence of right ventricular overload and/or dysfunction rules out pulmonary embolus as the cause of haemodynamic instability. Conversely the presence of RV overload or dysfunction where pulmonary embolus is confirmed or suspected, can justify the need for urgent reperfusion treatment even where CT angiography is not immediately available. Where shock or severe hypotension exists, the decision to thrombolyse or undertake intervention to remove the embolus, is easy. However it is the group where relative hypotension exists in the presence of suspected acute pulmonary embolus that echocardiography can greatly assist the critical care physician in deciding on the appropriate therapy. For example the findings of a compromised right ventricle contraction combined with intracardiac thrombus and compromised left ventricular filling may lead directly to aggressive treatment such as thrombolysis in the preshock patient. Conversely where there is good right ventricular contraction with only moderate pulmonary hypertension present, the decision may be to treat with heparin or equivalent. Therefore in the Intensive Care setting the rapid bedside application of echocardiography to assess right ventricular function, particularly when combined with positive troponin or naturetic peptides, becomes crucial. The principle markers of right ventricular dysfunction acute pulmonary embolus include reduced right ventricular contractility, pressure overload where measured by the tricuspid regurgitant signal or acceleration time of the pulmonary outflow, and TAPSE. The McConnell sign of depressed right ventricular free wall but good apical contraction is used as a parameter by some clinicians.

The scope for performing an echocardiography on a haemodynamically compromised patient with suspected acute pulmonary embolus goes much further, as it will also identify alternative cardiopulmonary reasons for the patients deterioration.
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CHOOSING THE APPROPRIATE ANTICOAGULANT FOR THE TREATMENT OF VENOUS THROMBOEMBOLISM

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The critically-ill patients have many of the factors that can increase the risk of venous thromboembolism (VTE) and thus the care of critically-ill patients may be complicated by venous thromboembolism. Once VTE is diagnosed in a critically-ill patients the clinicians must decide the most appropriate agent for anti-coagulation therapy. Traditionally, parenteral unfractionated heparin (UFH) and low molecular heparin (LMWH) has been used most commonly. In non-ICU setting, LMWH may be preferred over UFH for initial treatment of VTE. But many ICU patients have high risk of bleeding and/or have impaired kidney function, in which circumstances UFH may be considered over LMWH. Also, bioavailability of LMWH is not well established in the critically-ill. Another agent that can be used in fondaparinux but this agent has long half life, is excreted by the kidney, and there is no specific antidote thus limiting its usage in the ICU setting. In patients with excessive bleeding risk, IVC filter may be used but these patients should be switched to anti-coagulation therapy as soon as the excessive bleeding risk abates. In non-ICU setting oral Vitamin-K antagonist (VKA) should be started early with the parenteral anti-coagulants but this is not possible in many critically-ill patients. Likewise the role of New Oral Anticoagulants (NOAC) is not well-studied in the ICU setting. In patients with heparin-induced thrombocytopenia (HIT), heparin should be stopped and the patients treated with non-heparin anti-coagulants such as argatroban. In conclusion, the choice of anti-coagulants for VTE should be tailored to patient characteristics and underlying disease.
MANAGEMENT OF SUB MASSIVE AND MASSIVE PULMONARY EMBOLISM: EVIDENCE AND CONTROVERSY

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Physicians treating acute life-threatening pulmonary embolism (PE) are faced with difficult clinical decision at some point of care of these rapidly evolving situation. Evidences and controversy in management of sub-massive and massive PE were reviewed and practical clinical approach suggested based on current best evidences to these 10 clinical dilemmas in PE:

Is this patient has sub-massive PE or massive PE?
Acute PE or chronic pulmonary thromboembolism (PTE)?
Should the patient get anticoagulant or thrombolysis?
Which should be the anticoagulant of choice for sub-massive PE: unfractionated heparin (UH) or low molecular weight heparin (LMWH)?
What is the optimal choice for thrombolytic agents?
What is the risk of thrombolysis in a patient with recent surgery?
Should thrombolysis be administered in patient with recent ischaemic stroke and hemorrhagic stroke?
Should we give thrombolytic agent in peri-arrest situation with suspected PE in the absence of definitive radiologic evidence of PE?
What is the management of choice for massive PE who failed to restore adequate perfusion after thrombolysis?
Repeated thrombolysis, non-surgical catheter based therapy, or surgical thrombo-embolectomy?
Which patients with acute PE may be benefit from IVC filter?
How should we manage a pregnant patient with life threatening PE?
What is the role of the newer oral agents in the management of acute life threatening PE?

Some of these clinical dilemmas of life threatening PE the evidences are limited from the rapidly progress of these conditions, make it less feasible to conduct the randomized control trial. Case series are potentially hampered by bias. Individual patient management require clinical assessment of overall risks and benefits and will also depend on local availability of therapeutic interventions in each institutes.
ASSESSMENT OF ICU PERFORMANCE

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The intensive care unit (ICU) is one of the major components of the current health care system. The advances in supportive care and monitoring resulted in significant improvements in the care of surgical and clinical patients. Nowadays aggressive surgical therapies as well as transplantation are made safer by the monitoring in a closed environment, the surgical ICU, in the post-operative period. Moreover, the care and full recovery of many severely ill clinical patients as those with life-threatening infections occurs as a result of intensive care.

However, despite many significant advances in various fields as mechanical ventilation, renal replacement therapy, antimicrobial therapy and hemodynamic monitoring this increased knowledge and the wise use of such technology is not available for all patients. Shortage of ICU beds are an important issue, however even when ICU beds are available significant variability in treatment and in the adherence to evidence-based interventions do not occur.

To ensure better performance, we should Evaluate ICU situation aiming for improving the effectiveness of our practices taking in consideration that Performance is more than effectiveness.

Performance includes the efficiency of our practices, their cost-effectiveness, both within the scope of intensive care medicine and in comparison to other health interventions.

Performance measures Effectiveness includes Efficiency, Customer and staff satisfaction.

Every ICU should have a systems-oriented Performance Improvement Program that is multidisciplinary and inclusive and has the support of the hospital and ICU leadership needed to succeed if ICU performance is to improve.

Several measures of ICU performance have been proposed in the past 30 years. It is intuitive, and correct, to assume that ICU mortality may be a useful marker of quality. However, crude mortality rates does not take into consideration the singular aspects of each specific patient population that is treated in a certain geographic region, hospital or ICU.

Improving ICU performance involves sequential steps of:

1. measuring relevant indices of ICU performance,
2. making interventions aimed at improving those measures,
3. re-measuring the indices to document the effect of the intervention.

Therefore approaches looking for standardized mortality ratios that are adjusted for disease severity, co-morbidities and other clinical aspects are often sought. Severity of illness is usually evaluated by scoring systems that integrates clinical, physiologic and demographic variables. Scoring systems are interesting tools to describe ICU populations and explain their different outcomes.
HOW TO MEASURE “FUTILITY”? 

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The American Medical Associations Council on Ethical and Judicial Affairs has deemed futility indefinable; consequently, many terms have been used to mask its connotations. Healthcare practitioners are confronted with extremely difficult medico-legal and conflicting ethical situations every day. Some examples of practical frameworks exist; however, the lack of a definition or agreement among a wide range of professionals, from ethicists or administrators to physicians, makes individual decisions extremely complex.

In this lecture, we will:

1) Review the different names and bases for their existence
2) Examine some of the objective definition attempts
3) Propose a measure of futility
4) Discuss a practical framework for the use of a stratified approach of this measure
COST CONTAINMENT AND PATIENT SAFETY

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There is an ongoing demand for quality patient care and reduction of human errors. This lecture will discuss the relationship between cost containment and patient safety.

Being safer does not always mean higher costs; sometimes change of practice means lower cost without worsening patient safety. One example of this is to abolish routine chest X-ray in ICUs. Another example, when a small capital investment is needed, is the use of real-time ultrasound for central venous catheter (CVC) insertion.

In a critical analysis of patient safety practices, available evidence points heavily towards injuries from care, that are not caused by errors. For example, use of sterile barriers during catheter insertion, use of pressure relieving bedding materials or continuous aspiration of subglottic secretion all demonstrate strong evidence of preventing injuries from care. These technical advances, which have been shown to prevent complications, are cost-effective as well, in terms of their reduction of length of stay.

Some of the untoward inpatient events can be prevented as well, for example, in the case of inpatient falls, or early recognition of cardiopulmonary arrest on ward using bed alarms. The cost-effectiveness of an early-alert surveillance system for these two conditions is justified with a daily economic benefit of 14.6 US$ per patient assuming a 40% reduction in the fall rate and a 25% reduction in the cardiopulmonary arrest rate.

Each intensive care unit should have their safety culture in mind: have they done everything possible to reduce errors? We may have to report sentinel events to an institutional safety officer within 24 hours of an occurrence. There are other key areas for improvement, both in regards to internal and external education and training, as well as manual development and maintenance of medical equipment. However, these activities require extra staff to be employed. How much does it cost? 1 full-time equivalent (FTE) for an average size 250 beds hospital will make a difference; this can be seen as a good investment in improving patient safety.
REPORT OF THE TASK FORCE OF THE WFSICCM: ICU DOCTOR

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SYNTHETIC COLLOIDS STILL HAVE A ROLE IN THE ICU (PRO)

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Almost all intensive care unit (ICU) patients will require intravenous fluids at some point. Which fluid should be used continues to be a matter of debate. Crystalloid solutions are inexpensive and generally well-tolerated, but infusion of large volumes of saline solutions can lead to hyperchloremia and this may increase the risk of acute kidney injury. Balanced solutions may be preferable but these too have their limitations. Colloid solutions leak less into the interstitial space than crystalloid solutions and may, therefore, be associated with less tissue edema and its associated effects on wound healing, oxygenation, gut function, etc. Importantly, each colloid solution has a specific profile. The only natural colloid is human albumin, which may be indicated in certain groups of patients, especially those with sepsis and hypoalbuminemia. Albumin has been shown to be safe when used in critically ill patients. Its use may be guided by blood albumin levels, like blood transfusions can be guided by hemoglobin levels. The artificial colloids include gelatin solutions, dextran solutions, and hydroxyethyl starch (HES) solutions, all have potential adverse effects. While crystalloids represent the first-line fluid type for resuscitation of most ICU patients, colloid solutions should be considered in certain patient groups, including those likely to need large fluid volumes. No fluid is perfect. Intravenous fluids should be considered and prescribed as medications, taking into account individual patient factors and needs, concomitant disease processes and treatments. Using a combination of several fluids rather than excessive amounts of any one will help limit adverse effects.
VOLUME REPLACEMENT IN THE CRITICALLY ILL

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Intravenous fluids are drugs that have entered the market before regulatory requirements made phase 1-3 clinical trials mandatory to prove safety and efficacy. Meta-analyses by the Cochrane Collaboration have consistently concluded that administration of colloids provide no survival benefit over use of crystalloids. There is now growing evidence that the type of fluid may directly affect patient-centered outcomes.

Hydroxy-ethyl starch (HES) increases the risk of death, kidney injury, and bleeding. Both the US-American and European regulatory bodies have reacted and issued restrictions. HES must no longer be given to critically ill and septic patients, and its use outside the ICU is restricted in Europe to patient groups which cannot be stabilized with crystalloids alone, do not suffer from coagulopathy, and treatment should not exceed 24 hours. The evidence on surgical patients and patients in the emergency setting is poor. The existing evidence suggests that HES leads to renal failure and increased bleeding also in surgical patients and to increased mortality in trauma patients. HES is stored in the RES of the body and leads to deposits in the kidney, spleen, liver, bone marrow and cutaneous nerves and contributes to organ dysfunction and leads to coagulation impairment.

Gelatin solutions are also synthetic colloids derived from bovine collagen. In some places, gelatin use increases to substitute for HES. Dextran is a sugar polymer. However, both gelatin and dextran have a similar risk-benefit profile as HES, with evidence for risk of increased bleeding and renal failure. There is lack of high-quality data from large-scale clinical trials to prove the safety of these i.v. fluids. Meta-Analyses from the Cochrane Collaboration have consistently shown that gelatins and dextrans have no benefit over crystalloids. Like HES, gelatins and dextrans would not be approved today and should best be avoided.

Albumin is the body’s own natural colloid solution, however it has important pharmacological activity as well. Albumin is recommended in the treatment of hepato-renal syndrome and of refractory ascites and suggested in patients with septic shock sepsis when it is not possible to stabilize the patients with crystalloids. Albumin is associated with increased mortality in patients with severe traumatic brain injury and should be avoided in these patients.

Crystalloids, such as saline or balanced salt solutions, are recommended as first-line resuscitation fluids in hypovolemia. There is some suggestion that chloride-rich solutions such as saline may be associated with adverse outcomes due to the development of hyperchloremic metabolic acidosis. There is growing evidence that excessive use of fluids during the resuscitative period is associated with increased cumulative fluid balance and adverse outcomes in critically ill patients. Large-scale trials are called for.

In summary, isotonic, balanced salt solutions should be used as first-line resuscitation fluids and isotonic saline solutions can be considered in alkaleotic patients. Fresh whole blood or blood components should be used in actively bleeding patients. Natural colloids should be given with care and only in selected patients if hemodynamic stabilization is not adequate with first-line fluids and vasopressors.
STEROIDS SHOULD BE USED TO TREAT PATIENTS WITH SEPTIC SHOCK (PRO)

John Marini

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STEROIDS SHOULD BE USED TO TREAT PATIENTS WITH SEPTIC SHOCK (CON)

Charles Sprung
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The use of steroids in septic shock has been controversial for decades (1). During the late 1980s and 1990s, however, the consensus was that corticosteroids should not be used (2,3). Subsequent studies demonstrated hemodynamic benefits with lower doses of steroids for longer periods (4-6).

Annane (5) evaluated low dose hydrocortisone in patients with severe septic shock in a multicenter, randomized, placebo-controlled, double-blind study. 299 patients were analyzed. Shock reversal was more common (57%) in steroid-treated patients than patients receiving placebo (40%) and more rapid. 28-day mortality was decreased by steroid therapy in all patients (61% vs. 55%) and non-responders (63% vs. 53%). Based principally on the Annane study, the 2004 Surviving Sepsis Campaign recommended the use of low dose hydrocortisone for septic shock (7).

In a subsequent multicenter, randomized, placebo-controlled, double-blind study- Corticus (8) a total of 499 patients were analyzed. There were no differences in 28-day mortality for patients receiving hydrocortisone or placebo in nonresponders (39% vs. 36%), responders (29% vs. 29%) or all patients (34% vs. 32%). In patients reversing shock, shock reversal was faster in patients receiving hydrocortisone rather than placebo in all three groups. Hydrocortisone-treated patients had more episodes of superinfection, new sepsis and septic shock.

The updated 2012 Surviving Sepsis Campaign recommended not using hydrocortisone if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability. If this is not achievable, hydrocortisone alone is suggested (9). The guidelines recommend that corticosteroids not be administered for without shock (7, 9). Several meta-analyses have addressed the issue. Annane found a significant reduction of 28-day mortality (10) whereas Sligl and Patel showed no difference in mortalities (11, 12). The meta-analyses noted improved shock reversal with steroids (10-12). The definitive answer on the use of steroids in septic shock should come from TheADjuNctive coRTicosteroid trEatment iN criticAlly ill Patients With Septic Shock trial currently being performed.

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GUIDELINES ARE THE FUTURE OF SEPSIS MANAGEMENT (PRO)

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Clinical practice guidelines improve the quality of decision making, create explicit recommendations, improve consistency of care, clarify proved benefit and document the quality of supporting evidence and support quality improvement activities. Guidelines are essential to move clinical care process; however, this is not done directly but rather indirectly. Guidelines are necessary as a framework for the application of evidence based medicine to create the best current recommendations; however, guidelines themselves have minimal impact on influencing bedside behavior. It is the derivation of protocols and bundles that make a difference in patient care. Without guidelines as a framework there would be no base for pushing forward with protocol and ICU bundle quality indicators. Protocols are a logical extension of guidelines centered on patient care flow and when followed facilitate achievement of the quality indicators contained within the ICU bundles. Guideline recommendations should not eliminate the need for clinical judgment. To the contrary, constant attention is needed to detect the subtleties inherent in each patient. The presence of guideline derived protocols and ICU bundles should not negate deviations when a particular patient scenario warrants. Likewise neither are a substitute for the lifelong learning process. In fact, as new evidence becomes available, new guidelines become available, new quality indicators evolve, new protocols are developed and up to date and successful ICU bundles arise. The current sepsis guidelines are good until the next revision becomes better. Validity of sepsis guidelines is established though references and evidence grading. However, knowledge is like paint, it does no good until it is applied. Dissemination and application of the sepsis guidelines has been very important. Application of guideline recommendations are different in resource unlimited vs resource limited environments. In the latter case it may be impractical or impossible to follow specific recommendations and instead alternatives are necessary. There are layers to the current SSC guidelines that include recommendation, rationale and evidence based tables. One size does not fit all. As we move forward into the understanding of genomics and proteomics it is likely that we will need to adapt recommendations specific to patient makeup in these areas. The future of sepsis guidelines may expand to include eliciting lay public input during the creation process and specific guidelines for under resourced areas. Earlier identification of the target patient should become more and more important in the future as well as highlighting prevention. A simplified version of sepsis guidelines would be practical.
GUIDELINES ARE THE FUTURE OF SEPSIS MANAGEMENT

(CON)

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The development of guidelines such as those of the Surviving Sepsis Campaign is transforming patient care. Multiple cohort studies show that the survival of septic patients is increasing, and more specifically, that the dissemination and adoption of the guidelines of the Surviving Sepsis Campaign is an important factor in this improvement.

But guidelines are not the future of sepsis management. They reflect knowledge derived in the past, and applied in the present. Moreover that knowledge reflects the means of populations rather than what may be best for the individual patient. Clinical care is constantly changing, and unthinking adherence to a particular approach condemns the patient to an approach that becomes progressively more outdated with time. During the lifespan of the SSC guidelines, approaches to glycemic control, fluid management, and resuscitation have changed; a guideline tells us where we were, but not where we should go.

The alternative to guidelines, and I would argue the future of sepsis management, lies in developing clinical management models that engage patients in an ongoing process of research, modifying approaches in real time as data are accrued. This vision necessitates the wider adoption of novel research designs such as adaptive trials, and full integration of research into the process of patient care, but it promises to ensure that patients receive the very best care currently possible.
Invasive candidiasis remains a challenging problem. There are increasing numbers of cases, treatment is frequently being initiated too late, and sequelae, in terms of morbidity, mortality and prolonged hospital stay, are significant.

This talk offers a simple and practical way forward for what is universally deemed to be an ongoing complex issue - in a simple and practical fashion.

Virtually every paper written on the topic over the past several years has stated that the diagnosis of invasive candidiasis remains problematic. This need not be the case.

The talk will run through all that is relevant in the field, sharing a unique and simple template that in a practical and easy fashion, could and should change practice globally, thus making the diagnosis of invasive candidiasis much easier, irrespective of geographic area of practice. As a consequence, patient management and outcomes could be substantially optimized and enhanced.
VENTILATOR ASSOCIATED RESPIRATORY INFECTIONS: PNEUMONIA VS TRACHEOBRONCHITIS

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Ventilator associated-respiratory infections (VARI) are the most prevalent ICU-acquired infections. Ventilator associated pneumonia (VAP) is the leading cause of death related to infection in critically ill patients and the antibiotic use in the intensive care unit (ICU).

Although we have a lot of information about VAP, interest in the ventilator-associated tracheobronchitis (TAV) is recent, and the knowledge we have about it still scarce.

The differential diagnosis of VAP and VAT is overlapping and controversies over the specific diagnostic criteria for tracheobronchitis and pneumonia continue up to now.

Patients who develop VAP have high crude mortality rates that vary with disease severity and underlying host diseases. The impact of VAT in the outcome of critically ill patients is not clearly established.

In this talk, the available information about similarities and differences of these two infections will be reviewed, including the data from a large Spanish series.

The findings of our study (among 50,2012 mechanically ventilated patients) are that VAP and TAV had a similarly incidence, but the presentation of the episodes, especially systemic inflammatory response, and the impact on the ICU-stay and mortality, are clearly different.
PREVENTION OF CATHETER-RELATED BLOOD STREAM INFECTIONS

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Nosocomial bloodstream infections (BSIs) are an important cause of morbidity and mortality in critically ill patients. Intravascular catheters are widely used in clinical practice, and their use can predispose a large number of patients at risk of catheter-related BSIs (CR-BSIs). Approximately a half of cases occur in ICU, and CR-BSI is associated with increases in morbidity and mortality, length of hospital stay, and medical costs. Although ICU patients are generally exposed to many medical devices, the high incidence is thought to be related to a lack of official regulations regarding catheter care.

There are two main routes that microorganisms access intravascular catheters and reach the bloodstream: the spread of skin flora around the catheter insertion site and the catheter hub colonization with subsequent intraluminal spread to the intravascular portion of the catheter. To minimize CR-BSIs, sterile technique is important: strict adherence to hand washing and aseptic technique and, with central venous catheter (CVC) insertion, maximal barrier precautions including sterile gloves, long-sleeved surgical gown, a surgical mask, and a large sterile sheet drape. However, it was reported less than 30% were adopted maximal barrier precautions.

With long-term intravascular devices, the catheter hub is the most common site for CR-BSI. Appropriate catheter care is also important to minimize CR-BSIs. The needleless injection devices are considered to lower the risk of contamination of the catheter by reducing manipulation time and avoidance of ports being left open. However, the surface of needleless injection device is externally contaminated by microorganisms on the skin or the environment. Injection ports are usually disinfected by alcohol, while the technique does not reliably eliminate surface contamination. Antiseptic barrier cap with chlorhexidine-impregnated sponge provides high levels of protection. Only cap is also as effective as antiseptic barrier cap. Infusate can be contaminated from bacteria on a surface of the plug during bag/bottle exchanges.

Arterial lines frequently inserted in critically ill patients, while considerable concern is not necessarily showed to CR-BSIs associated with arterial lines. The incidence of contamination is higher than expected, because during arterial catheter manipulation, the system is opened for blood sampling. The blood conservation system (BCS) forms a closed infusion line and is expected to reduce complications caused by intraluminal contamination.

CR-BSIs are an important cause of morbidity and mortality in critically ill patients. To minimize the incidence, it is essential to keep appropriate regulations regarding catheter care.
THE ROLE OF NASAL HIGH-FLOW THERAPY FOR PATIENTS WITH HYPOXEMIC RESPIRATORY FAILURE

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Nasal cannulae high flow oxygen therapy is a relatively new and interesting technique to deliver humidified and heated gas at a controlled FiO2 and with high flow rates. It has been mainly used as a way to deliver high or very high fractions of inspired oxygen in hypoxemic patients in the emergency ward or in the intensive care unit. Apart from well controlling the FiO2 because of the high flow rates, the gas conditioning probably explains that it is very well tolerated and several studies showed an improved tolerance compared to usual oxygen mask. The high flow rates delivered through nasal cannulae explain that a relatively small level of positive airway pressure is generated in the throat, creating a continuous positive airway pressure-like effect, which depends on the degree of mouth opening. It ranges between 2 and 5 or 6 cmH2O. In addition, the high flow rates delivered during expiration seems to act as a wash-out of the oropharyngeal cavity, reducing the reinhalation of expired CO2 and therefore reducing dead space. This could be associated with a reduced need for minute ventilation and possibly a decrease in work of breathing, though we need better physiological studies about this. One single centre randomized trial suggested that it could prevent reintubation in hypoxemic patients after extubation. A recent multicenter controlled randomized trial in patients with hypoxemic respiratory failure mainly due to community-acquired or hospital pneumonia showed that this technique had better results than oxygen alone or noninvasive ventilation. It significantly reduced the need for intubation in patients with a PaO2/FiO2 ratio lower than 200 mmHg, and in the whole group of patients it significantly reduced intensive care unit, hospital and day 90 mortality. These extremely encouraging results suggest that it should constitute the first line therapy in those patients.
NASAL HIGH-FLOW ACROSS THE CONTINUUM OF CARE - THE MECHANISMS OF ACTION AND PHYSIOLOGICAL OUTCOMES

John Fraser

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Respiratory support of the critically ill has been an evolutionary process since mechanical ventilation was first described by Dalziel in 1838 in Scotland.

Negative pressure ventilation was then utilised for many years, but subsequently this technique was replaced by positive pressure ventilation following the polio epidemic.

However, much more recently, the mechanical support has progressed to less and less invasive and aligning closely to native physiology, with devices for non invasive ventilation becoming more responsive and easier to use.

Nasal high flow devices have now been realised to be part of the continuum of respiratory support adding much more that merely the ability to deliver high inspired oxygen concentrations.

The speaker will discuss recent mechanistic data associated with nasal high flow devices with regard to respiratory support as well as the effect of humidification in the respiratory system.

Through an improved understanding of the the mechanism of these devices, we can determine with a greater degree of certainty where these devices will provide the greatest improvements in the sickest patients.
Supplemental oxygen therapy remains a contentious topic. Potential clinical benefits of nasal high flow therapy include not just the provision of supplemental oxygen therapy, but importantly addition of extrinsic PEEP, provision of accelerated gas flow to the upper airway, increasing the FRC allowing for enhanced cough volumes and efficiency, and humidification of the upper airway.

The use of the Nasal High Flow therapy devices such as Optiflow™ has proven to be popular in many settings; this therapy adoption has been encouraged by the patient comfort and subsequent high-level compliance. Consequently in many clinical settings Optiflow has become the default baseline respiratory support, but clinicians need to have an understanding of its mechanisms to optimise patient benefit. It is recognised that Optiflow can offer considerable support to patients requiring respiratory support in a range of clinical setting settings, in addition to enhancing patient care, whilst avoiding or preventing complications. Potential applications include for: traumatic chest injury, postoperative support, acute inflammatory and infectious disease, transportation (including at altitude), during procedures, prior to intubation, immediately after extubation and for palliative comfort.
NASAL HIGH-FLOW THERAPY AS A QUALITY IMPROVEMENT STRATEGY IN A PROVINCIAL COMBINED ICU / HDU / CCU

Troy Browne
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Quality health care may be defined as the degree to which health services for individuals and populations increase both the likelihood of desired health outcomes, and the degree of consistency with current professional knowledge. Numerous factors contribute to the current complexity of health care. These factors include: practices that are inefficient but entrenched, changing case mix of patients, funding variances, and differences in the education and experience of clinicians. The quality of healthcare may be compromised if all these variances are not actively managed.

Quality and safety improvement strategies are the convention of the modern healthcare arena. All health quality improvement strategies should incorporate benchmark indicators including: effectiveness, safety, patient-centredness, timing, efficiency, and equity. Introducing Nasal High Flow (NHF) therapy as a standard for Oxygen therapy in a provincial combined ICU / HDU / CCU was a quality and safety improvement strategy with effectiveness and safety as primary outcome improvement indicators. Using controlled clinical trial methodology, and in association with both clinical evidence and professional consensus, we studied the degree to which this strategy influenced the quality of care in our combined ICU / HDU / CCU.
VENTILATORY CARE AND WEANING STRATEGY

Chun Kee Chung

Seoul National University College of Medicine, Republic of Korea

Acute spinal cord injury (SCI) often results in alterations of cardiopulmonary function that require intensive care management. Respiratory complications following SCI are the leading cause of morbidity and mortality. Mechanical ventilatory care is significant part of treatment in these patients, but critical complications need to be considered. The aim of this presentation is to explain the ventilatory care and weaning strategy in SCI patients and to introduce cases of our institution and portable ventilator.
FLUID RESUSCITATION IN CRITICALLY ILL PATIENTS

John Myburgh

University of New South Wales and the George Institute for Global Health, Australia

The administration of intravenous fluid for the resuscitation of critically ill patients is the most common intervention in acute medicine.

Despite its established role, there is wide variation on the selection and use of resuscitation fluids that is largely determined by clinicians’ preference, availability of the respective fluids, cost and the influence of commercial marketing.

Physiological considerations have formed the basis of the use of resuscitation fluids, with the suggestion that colloids are more effective in increasing depleted intravascular volume due to increased retention within the vasculature and a prolonged duration of action compared to crystalloids. Recent observations from high-quality blind RCTs comparing colloids to crystalloids have demonstrated that the purported crystalloid-sparing effect of colloids is overstated and that there is little difference between the volume expansion effect and oedema-genicity between the two fluid types. These observations may be explained by the impact of acute illness on the integrity and function of the endothelial glycocalyx layer that results in marked changes in tissue permeability in all vascular beds. The use of albumin for resuscitation in patients with severe traumatic brain injury is associated with an increase in long-term mortality that is mediated through exacerbations of increased intracranial pressure.

Similarly, other semi-synthetic colloids, such as hydroxyethyl starch and gelatins are associated with adverse patient-centred outcomes, specifically the development of acute kidney injury and coagulopathy. There is no substantive evidence that colloids confer any benefit over crystalloids for resuscitation.

However, while crystalloids are increasingly being used as the first line resuscitation fluid, particularly 0.9% saline, there is increasing concern about the development of hyperchloraemic metabolic acidosis and the development of acute kidney injury associated with 0.9% saline compared to buffered salt solutions. There is an imperative to conduct and appropriately powered RCT to determine this question.

Moreover, the volumes of resuscitation fluids over the duration of the index admission and associated adverse outcomes is an increasing concern, with the recognition that positive fluid balance associated with prolonged interventions and increased mortality, particularly in patients with acute lung and brain injury.

This has led to a ‘time-based’ fluid resuscitation paradigm that restricts the use of fluids to an initial ‘salvage’ phase – directed at restoring symptomatic hypovolaemia with the smallest volumes required – and in the initial phase of the subsequent ‘optimisation’ phase – directed at correcting ongoing, quantified fluid losses. Thereafter, resuscitation fluids should be used sparingly, if at all unless there are objective signs of symptomatic hypovolaemia.

There is a further imperative to conduct a high-quality RCT to determine the optimal ‘time-based’ fluid resuscitation strategy.
NEUTROPENIC SEPSIS: CRITICAL ISSUES AND TREATMENT CHALLENGES

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This session will discuss the challenging issues related to the diagnosis and management of sepsis in neutropenic patients. These patients often lack the cardinal signs of inflammation; thus, early diagnosis of infection and sepsis is not readily made. Neutropenic sepsis is defined as sepsis developing in patients receiving anticancer therapy with neutrophil count <500/mm³ or ≤1000 mm³ with expectation of further decline AND fever ≥38.3C (101F) or febrile state (≥38.0C (100.4F) for ≥1 hour). Factors associated with risk of infection in these patients include duration and severity of neutropenia, type and intensity of chemotherapy regimen, altered phagocytic, cellular, or humoral immunity, breach of skin or mucosal barriers, catheters and other foreign bodies, underlying disease or therapy and the use of corticosteroids. Gram-positive pathogens predominate in documented bloodstream infections with coagulase-negative staphylococci accounting for the majority but usually associated with minimal virulence. Resistant organisms increasingly are causing infections including penicillin-resistant viridans streptococci, methicillin-resistant Staphylococcus, vancomycin-resistant enterococci, and multidrug resistant gram negative rods. Procalcitonin (PCT) may be able to discriminate fever due to systemic infection from non-infectious etiologies and may be useful in outcome prediction in patients with febrile neutropenia but is not superior to IL-6 or C-reactive protein. Every patient with neutropenic fever should receive prompt empiric antibiotic therapy after presentation. Combination empirical antimicrobial therapy is recommended for neutropenic patients with severe sepsis and for patients with difficult to treat, multidrug-resistant bacterial pathogens such as Acinetobacter and Pseudomonas species. The duration of therapy is typically 7-10 days; longer courses may be appropriate in patients who have a slow clinical response, undrainable foci of infection, or bacteremia with S. aureus. Empiric antifungal therapy should be considered for high-risk patients such as those with persistent or recurrent fever after 4-7 days of antibiotics, and for those whose overall duration of neutropenia is >7 days. Granulocyte colony stimulating factor can shorten the degree and duration of neutropenia but has not been convincingly shown to impact overall survival in these patients. The IDSA and Surviving Sepsis guidelines provide a framework for the diagnosis, antimicrobial management and hemodynamic optimization of patients with severe sepsis and septic shock. Early effective antimicrobials and goal-directed therapy to reverse organ failure in the ICU are keys to improving outcomes. Novel biomarkers of sepsis and innovative therapies are also eagerly anticipated.
MEASURING IMMUNE SUPPRESSION IN SEVERE SEPSIS

Anthony McLean
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The immune response to infection is too complex for evaluation by a single biomarker. Cytokine and genetic studies reveal that a combined pro and anti-inflammatory response occurs from the outset of infection and that the immune suppression relates to outcome. Autopsy studies in patients who die from severe sepsis reveal immunosuppression and associated unresolved opportunistic infections are common.

Effects of prolonged sepsis on the innate immune system include increased apoptosis of mononuclear cells with a reduction in antigen presentation to both B and T cells by dendritic cells, decreased cytokine secretion by NK and MDSC cells and increased IL-10 secretion by neutrophils. Lymphopenia in severe sepsis is well documented. In regard to the adaptive immune system the CD4+T, CD8+T, Treg and B cells all reveal immunosuppressive changes. The reduction of HLA-DR expression in sepsis correlates with mortality and risk of secondary infection, in part due to antigen presentation impairment on APCs. Although many of these abnormalities are identifiable in sophisticated laboratories, unfortunately they are not available in routine clinical practice. In specialized areas such as HIV infection, where CD4 T-cell count reduction is utilized, such advances are apparent but for the most part the critical care physician is reliant on crude measures such a total leukocyte count, lymphocyte numbers, eosinophil count and similar.

The use of genetic profiling to assess the immune status of the patient has come about because of the advent of microarray technology, allowing for the simultaneous measurement of very large numbers of genes. Studies vary in design and content but those performed on critically ill septic patients tend to show upregulation of genes involved with innate immunity and downregulated with adaptive immunity. Studies in both the adult and paediatric populations have identified potentially useful markers but large genetic signatures are still confined to the research laboratory. Further refinements are essential to specifically identify and measuring key genetic markers on a PCR or similar platform, making it accessible for clinical use.
BLOOD PURIFICATION IN CRITICAL CARE

Hiroyuki Hirasawa
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It is now widely recognized that some countermeasures against overwhelming immunoinflammatory response after definitive treatment for infection are promising therapeutic approach to severe sepsis and septic shock. However until today, no such effective countermeasures against overwhelming immunoinflammatory response in sepsis are applied in clinical settings. Even in the Surviving Sepsis Campaign guidelines published in 2013, no recommendations are described on the countermeasures against overwhelming immunoinflammatory response.

On the other hand we reported that continuous hemodiafiltration with a cytokine-adsorbing hemofilter (CAH-CHDF) can effectively, continuously, and non-selectively remove pro- and anti-inflammatory cytokines from blood stream and that thus CAH-CHDF can decrease the blood levels of those cytokines. Furthermore, we reported that such removal of pro-inflammatory cytokines with CAH-CHDF and resultant decrease in blood level of those cytokines could improve many symptoms of sepsis caused by hypercytokinemia such as dysoxia, hyperglycemia (dysglycemia), coagulation abnormality, endothelial hyperpermeability, hyperpyrexia and DIC. Furthermore we reported that such removal of anti-inflammatory cytokines with CAH-CHDF could improve the immunoparalysis which was very important pathophysiological features for overwhelming infection in septic patients.

There are two kind of cytokine-adsorbing hemofilters for CHDF are in clinical use in Japan. Namely a polymethacrylate membrane hemofilter and an AN69ST hemofilter. We applied CAH-CHDF on septic patients aiming at the removal of cytokines even when those patients did not have renal dysfunction under non-renal indication. And we could obtain better survival with CAH-CHDF compared to the survival of other studies where no countermeasures against hypercytokinemia had been applied.

There are some concerns that when only pro-inflammatory cytokines are removed, immunoparalysis might be developed due to the imbalance between pro-inflammatory and anti-inflammatory cytokines blood levels (low pro-inflammatory cytokines blood level and high anti-inflammatory cytokines blood level). However, CAH-CHDF can remove both pro- and anti-inflammatory cytokines non-selectively, and therefore such imbalance in cytokines blood levels and subsequent immunoparalysis would not be taken place.

Thus, we conclude that the CAH-CHDF is effective countermeasures against overwhelming immunoinflammatory response due to hypercytokinemia in sepsis.

Reference
THE FUTURE OF HEMODYNAMIC MONITORING

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In an ideal world, the future in hemodynamic monitoring should be the sum of what we already have plus what we don’t have so far but what we need. In addition, the inevitable progresses in technology and data processing should make in the next future this field totally different from what we currently know.

Today, we have essentially hemodynamic monitoring devices able to monitor traditional macrocirculatory variables such as arterial blood pressure and cardiac output (CO) as well as more novel variables such as ScvO2, pulse pressure variation, extravascular lung water. Two main characteristics of the current hemodynamic monitoring systems are their invasiveness and their inability to assess tissue perfusion and oxygenation.

Today, the noninvasive hemodynamic monitoring technologies are not accurate and precise enough to be utilized in the intensive care unit (ICU). Noninvasive CO monitors can be used in operating room patients not for their accuracy but for their ability to track CO changes, which is the most important issue in this context, since the starting CO is generally normal. By contrast, in the ICU, we need both measuring accurate absolute CO values and reliably tracking the CO changes. Obviously, we hope that future technological progresses will provide ICU doctors and nurses with reliable noninvasive hemodynamic monitoring systems.

The other important aspect is to be able to monitor tissue perfusion. We have learnt from the recent years that correcting the macrocirculatory variables cannot guarantee that tissue hypoperfusion has been corrected too. Over the last decade, some technologies have been developed to noninvasively monitor microcirculation of the sublingual area (sidestream darkfield (SDF) imaging) or tissue oxygenation (near infrared spectroscopy (NIRS)). However, these techniques are currently still used for research and not for the routine practice. Regarding the SDF technology, recent technological developments now allow on line and automatic measurements of the main macrocirculatory variables, so that we can expect in the next future a real jump in this field allowing ICU doctors and nurses to monitor in real-time the microcirculation. The NIRS technology still fails to be implemented in every ICU. It is disappointing since at the brain level, it can provide important information about cerebral microcirculation and at the thenar eminence level, important information about the functional microcirculatory reserve. Among the reasons of the failure of the NIRS technology to be widely implemented are the too high cost of the disposable materials and the nave thinking that the lack of proof of improvement of patients outcome with such a technology cannot allow using it. We can hope that both the industry companies and the ICU physicians will understand the need of developing these techniques in the next future.

Finally, the technological progresses should also allow collecting and analyzing together many hemodynamic variables. This should help clinicians to better understand the hemodynamic situation and to be informed about what other clinicians would do in a similar situation. Nevertheless, a software, even sophisticated, must never replace the doctor or the nurse to make any therapeutic decision, even in the future.
THE FUTURE OF IMAGING IN CRITICAL CARE MEDICINE

Guido Musch

Massachusetts General Hospital, United States
THE FUTURE OF MECHANICAL VENTILATION

John Marini  
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The ability to compensate for life-threatening failure of respiratory function is perhaps the signature technology of intensive care medicine. Unchanging needs for providing effective life-support with minimized risk and optimized comfort have been, are now, and will be the principal objectives of providing mechanical ventilation. Important lessons acquired over nearly a half century of ICU care have brought us closer to meeting them, as technological advances in instrumentation now effectively put this hard-won knowledge into action. Reducing the adverse impact of mechanical ventilation will entail more precise and integrated monitoring of gas exchange, and cardiovascular tolerance as well as transpulmonary pressures. Better patient-ventilator interfacing to synchronize with power demands and attenuated demand for airway pressure will reduce the adverse consequences of ventilator support. Rising demand in the face of economic constraints is likely to drive future innovations focused on reducing the need for user input, automating multi-element protocols while carefully monitoring the patient for progress and complications.
THE FUTURE OF INTENSIVISTS

J. Christopher Farmer

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Critical Care is not a place. Today, the acuity and complexity of hospitalized patients has greatly increased. The ICU is no longer the only place where we routinely care for critically ill patients. Furthermore, there is an increasing population of patients who are critically ill when they leave the confines of a hospital. Finally, the number of patients with chronic critical illness are increasing. All of these important epiphenomenon are significantly changing the scope and practice of critical care medicine. In this lecture, we will discuss current trends, changing demands, and outline the role and responsibilities of future critical care practitioners.
HOW DOES IT SUPPORT ISOLATED HOSPITALS AND ICUS

Edgar Jimenez
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IMPROVING PRACTICE IN THE ICU

Ruth Kleinpell
Rush University College of Nursing, United States

Improving practice in the intensive care unit (ICU) is an ongoing expectation for critical care practitioners, to ensure that best care practices are being used to achieve optimal outcomes for critically ill patients. Yet, variations in care practices exist globally. While some differences are due to limited resources and funding considerations, others are often due to slow adaptation of evidence based practice, lack of empowerment to institute clinical practice changes for the betterment of patient care, and resistance to change. Targeting these areas can enhance critical care practices globally.

How can practice be improved in the ICU? Ensuring practice that is consistent with clinical practice guidelines and recommendations for care of the critically ill patient is an essential starting place to improve care in the ICU. Research has demonstrated that clinicians often perceive the care they provide is consistent with clinical practice guidelines, yet audits and practice evaluations have identified significant inconsistencies. Are you auditing practices in your ICU to evaluate care? If so, what are the results and how are you improving practices? If not, why are you not evaluating your clinical practices?

Designating ICU quality metrics is one way to promote the measurement and improvement of clinical practice. Indices such as length of stay, mortality rates, ventilator days, and ICU readmission rates can provide data to make comparisons, yet factors such as patient severity of illness, comorbidities, or genetic polymorphisms need to be considered. Other metrics such as central line associated infections, urinary catheter associated infections, pressure ulcer incidence rates, reintubation and self extubation rates, among others, can provide information on the quality of ICU care. What ICU metrics are you measuring? How are you using the data to make improvements? If not, why?

ICU clinicians may find that they can identify areas to improve practices, yet they lack the ability to institute practice change, or they meet resistance from colleagues when changes are proposed. Change theories tell us that it can be difficult to alter established practices, habits, and familiar routines. Yet, is not changing or even resisting change improving care in the ICU?

Designating global areas for improvement in the ICU can help to promote consistency in practice, as well as encourage better care. Concepts including patient and family centered care designate several including open visitation practices in the ICU; family care conferences within 72 hours of ICU admission for all patients; family centered rounds with active participation of family members; pet and music therapy in the ICU; and family presence during resuscitation and invasive procedures. The focus on integrating palliative and end-of-life care in the ICU designate others including the use of palliative care triggers as routine screening; establishing goals of care for every ICU patient; and hospice care, if it is the right care for the patient.

The future of critical care depends on the efforts of clinicians to improve practice. Envisioning the future of ICU care is easy: lets just do it!
THE FUTURE OF EXTRACORPOREAL GAS EXCHANGE

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The impressive diffusion of ECMO led to the great improvement of this technology, and there are increasing numbers of reports describing simple forms of extracorporeal support, primarily aiming at CO2 removal. The actual indications for ECMO depend on the patients need and the physicians request. The choice of the technique may vary from low flow bypass with CO2 removal to high flow ECMO with total oxygenation support. If the aim is the treatment of life threatening hypoxemia, the clear cut indication is high flow veno-venous ECMO. If the patient, however, presents severe cardiac failure, veno-arterial ECMO must be used.
Hypothermia is the only therapy shown to improve outcome after cardiac arrest. Hypoxic-ischemic injury occurs within minutes after the loss of cerebral perfusion, and return of circulation can lead to further reperfusion related injury. Hypothermia has many mechanisms of action including decreased cerebral metabolic rate, inflammation, excitotoxicity, free radical production, blood-brain barrier permeability, and cerebral edema. Landmark studies from 2002 led to the widespread use of hypothermia to 33 degrees C in comatose survivors following ventricular tachycardia/fibrillation cardiac arrest. Literature since that time re-examines the indications and target temperature for treatment. Targeted temperature management to 36 degrees C with a focus on strict normothermia and fever control has emerged as a similarly effective therapy. Patients with other presenting cardiac rhythms should also be considered as possible treatment candidates. The use of hypothermia after cardiac arrest has significantly impacted neurologic prognostication. In this setting, many traditional predictors of poor outcome lack sufficient predictive value. Delayed prognostication beyond the conventional 72 hour time period should be considered in this population.
HYPOTHERMIA IN ACUTE ISCHEMIC STROKE

Gene Sung

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Hypothermia as a medical treatment has been used for hundreds of years, but only recently has there been definitive proof of benefit. A particular target of this therapy is the central nervous system. I will review the work done in the area of hypothermia for acute ischemic stroke and show why this is a promising area for new research and treatment.
HYPOTHERMIA AND IICP

Huemahn Choi

The University of Texas Health Science Center at Houston, United States

The treatment of intracranial pressure (ICP) has been the hallmark of prevention of secondary neurologic injury. Recent negative studies examining the clinical impact of ICP monitoring require further examination of our ICP treatment protocols. Therapeutic hypothermia has been shown to be a powerful neuroprotective agent in animal studies. However, prophylactic therapeutic hypothermia in traumatic brain injury patients has shown no impact on functional outcomes. Despite negative trials for ICP monitoring in TBI and prophylactic hypothermia after TBI, therapeutic hypothermia is still a valuable agent for the control of elevated ICP. This session will discuss treatment of ICP after acute brain injury, review indications for the use of therapeutic hypothermia, review evidence of efficacy of hypothermia for treatment of elevated ICP and discuss the potential mechanisms of action. The medical management of the hypothermic patient in the critical care setting will be a focus.
HYPOTHERMIA IN TRAUMATIC BRAIN INJURY AND POST CARDIAC ARREST PATIENTS - TWO MULTICENTER CLINICAL TRIALS IN JAPAN

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Background Although mild therapeutic hypothermia (MTH) reported to be effective on neuro-protection in post cardiac arrest syndrome (PCAS) patients, recent randomized controlled clinical trials (RCTs) have not shown consistent benefits not only in PCAS, but also in traumatic brain injury (TBI) patients1-4.

Methods We conducted two multicentre clinical trials in Japan5-6. First, the study was non-blinded single-arm, prospective, multicenter and sponsored trial. Comatose PCAS patients (n=24) were cooled to 33.0C and for 24 hours by an intravascular catheter-based heat exchange system (IVTM). Re-warming speed to 36.5C was less than 0.1C /hour. Second, patients with severe TBI (GCS 4-8, n=148) were randomly assigned (2:1 allocation ratio) to either MTH (32-34 C, n=98) or fever control (35-37C, n=50) group. Brain computed tomography (CT) were classified by Traumatic Coma Data Bank classification (n=135). Patients were cooled as soon as possible for ≥ 72 h and re-warmed to 36.5C at a rate of < 1.0 C/day, mainly by a surface cooling system or partly by IVTM. All patients received tight hemodynamic monitoring under intensive neurological care. Cerebral performance category (CPC) of the patients at 14 days (PCAS) or GOS at 6 months was assessed by physicians.

Main results: In the PCAS trial (n=24), core body temperature could be reached to less than 34.0C within 3 hours from the start of cooling in all subjects5. The cooling speed was 2.7(2.2-3.6) C /hour (median, interquartile). The maintenance temperature (setting 33.0 C) could be kept at 33.1(33.1-33.1) C and the post-re-warming temperature (setting 36.5C) could be kept at 36.6(36.5-36.6) C. CPC 1, 2, 3, 4 and 5 was in 11, 1, 2, 9 and 1 patients, respectively. Safety of the cooling system was confirmed to be well within permissible levels.

In the TBI trial (n=148), patient backgrounds were similar between the two groups. Favorable neurological outcome were high, 47% and 52% in MTH and fever control groups, respectively. There were no significant differences in the likelihood of poor neurological outcome (relative risk [RR] 1.24, 95% CI 0.62-2.48, p = 0.597) or mortality (RR 1.82, 95% CI 0.82-4.03, p = 0.180) between the two groups. In additional analysis (n=135), favorable neurological outcome significantly increased from 33.3% in fever control patients to 77.8 % in MTH patients, whose age was less than 50 years old and had evacuated mass lesion7. Patients with diffuse injury III who were treated with MTH had significantly high mortality than those treated with fever control.

Conclusion: The intravascular heat exchange system was accurate and reliable system for targeted temperature managements (TTM) in PCAS patients. In the TBI trial, the patient group, age < 50 years old with evacuated mass lesion had statistically significant favorable neurological outcome. The IVTM system would bring a simple solution to clarify the definitive effects of MTH or TTM by RCTs in near future.
MANAGING SCRUB TYPHUS IN ICU

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Scrub typhus is a tropical bacterial infection caused by Orientia tsutsugamushi. It is transmitted by the larva of the trombiculid mites called chiggers. The usual cycle is rat – to mite – to rat, humans being accidentally infected when they are bitten by the chiggers. It is endemic to a 13,000,000 square km of the Asia Pacific rim extending from Afghanistan to China, Korea, the islands of the southwestern Pacific and Northern Australia1. In India, it has been reported from Himachal Pradesh in the north to Tamil Nadu in the south indicating that it can occur in a variety of ecological conditions from cold to tropical climates.

The incubation period is typically 1 to 3 weeks. An eschar forms at the site of bite but this is frequently missed. The typical clinical features are sudden onset of fever, headache & myalgia accompanied frequently by delirium, nausea, vomiting, cough and jaundice. A maculopapular rash that begins on the trunk and spreads to extremities may also be seen2.

The common complications that may necessitate ICU admission are hepatitis, aseptic meningitis, meningencephalitis, thrombocytopenia, ARDS, pneumonitis, renal failure and shock2.

The widely available Weil Felix test is notoriously unreliable. The gold standard test is the indirect immunofluorescence assay (IFA). Indirect immunoperoxidase (IIP) is a modification of the standard IFA method that can be used with a light microscope and gives comparable results to IFA. There are also available ELISA and rapid point of care tests that have comparable sensitivity and specificity to IFA3.

Treatment is with doxycycline while rifampicin, azithromycin or fluoroquinolones are alternatives4.

Efforts to produce a vaccine have not been fruitful due to multiple serotypes and extensive antigenic variation1.

Scrub typhus is a common cause of ICU admission in South East Asia and a recent cohort of 623 patients from South India has reported decreasing mortality over a four year period. Sporadic cases are also reported from all over India5. This should encourage physicians and families to treat these patients aggressively, and with a great deal of optimism.

References

EMERGING AND RE-EMERGING VIRAL TROPICAL DISEASES

Jorge Hidalgo

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The twenty-first century has enabled us to move around the world with enormous facility whether you are traveling for business or pleasure or curiosity about the planet. We are living in a global village, in a world of microbes, so likewise the various demographic diseases of the continents have caught up with travelers going back to their destination. Average, more than 800 million people travels and cross border annually; whether associated with tourism, humanitarian efforts, globalization of industry, or migration for work. The composition of those traveling continues to become more diverse and medically complex, creating a vastly different perspective on travel-associated medical concerns, preparation and required medical knowledge. There are several life-threatening illnesses that a traveler can acquire and fever in a returning traveler may be benign and due to self-limiting infection, it must initially considered as a medical emergency. All of us witness the Ebola Outbreak as an example of a re-emerging viral diseases of a condition that just to belong to a specific geographic region, however, the way we move those days put the world in a vulnerable position. We will discuss the most frequent viral emerging and re emergin viral diseases in this section.
MALARIA IN THE CRITICALLY ILL

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Malaria accounts for about 2 million deaths per year. Malaria is a parasitic infection transmitted by mosquitoes is now confined to more tropical and subtropical climates.

Over 40% of the world's population lives in malaria-endemic areas. The majority of cases and almost all deaths are caused by Plasmodium falciparum. Plasmodium vivax, Plasmodium ovale and Plasmodium malariae cause less severe disease. The parasite is transmitted by the bite of the female Anopheles mosquitoes. High parasite burdens combined with the unique ability of infected erythrocytes to adhere to host endothelium contribute to microvascular occlusion, metabolic derangement and acidosis, which lead to the manifestations of severe malaria (acute respiratory distress syndrome, renal insufficiency and cerebral malaria). Blood concentrations of proinflammatory cytokines are raised in cerebral malaria. Fever and splenomegaly are the most frequent physical findings on examination. Severe malaria usually occurs with parasitemia of 5% or more, and even with optimal management, the mortality rate exceeds 20%. Thrombocytopenia occurs in up to 70% of patients and anemia in 25%. The leukocyte count is normal or low. Liver function test results are often abnormal; increased LDH in up to 80%. Hypoglycemia is may be present more likely in those with very high parasitemias. Metabolic acidosis is usually associated with severe disease. Chest X-ray may reveal evidence of acute lung injury.

Thick and thin peripheral blood smears, stained with Giemsa stain, remain the gold standard for routine clinical diagnosis. The rapid antigen detection tests, which detect parasite proteins in finger-prick blood samples can currently identify only P. falciparum and P. vivax.. Polymerase chain reaction (PCR) is a sensitive (> 90%) and highly specific (almost 100%) test, PCR remains largely an investigational tool. The treatment of malaria depends on the infecting plasmodia species, the geographic area of acquisition (which affects the likelihood of drug resistance) and the severity of infection. Quinine remains the most widely used antimalarials drug in the treatment of severe malaria, but decreased sensitivity has been detected in areas of South East Asia. Infection caused by P. malariae is easily treated with chloroquine alone except possibly in Indonesia, where resistant strains have recently been reported. People with severe falciparum malaria and those unable to tolerate oral regimens require parenteral therapy. Quinine is the preferred parenteral therapy; if quinidine must be used, cardiac monitoring is required to watch for QT-interval prolongation. Combination therapy should ideally, be safe and well tolerated, efficacious and effective.

Multidrug resistance in parasites has made combination of antimalarial regimens mandatory. Resistance to the Artemisinin has now being reported. Clinicians should ensure that patients with high parasitemias should receive a full course of adequate doses of Artemisinin combination treatment would be an effective method of slowing the emergence of antimalarial drug resistance.

Suggested reading
MANAGEMENT CONVULSIVE SPASMS OF TETANUS

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*University of Airlangga, Indonesia*

Tetanus is a potentially fatal disease caused by an exotoxin produced by the Clostridium tetani. It is characterized by generalized rigidity and convulsive spasms of skeletal muscles. The muscle stiffness usually involves the jaw and neck and then becomes generalized muscle rigidity that can cause respiratory failure, requiring admission to an intensive care unit (ICU) and mechanical ventilation. It generally could be prevented by immunization in the childhood era.

This disease still prevalent in the developing countries especially in Asia and Africa, though there is marked reduction the incidence. The disease can affect any age group and case-fatality rates are high even where modern intensive care is available. Neonatal tetanus is the most serious form of the disease and has a higher mortality rate. In 1988, WHO estimated that 787,000 newborns died of neonatal tetanus although it decreased in 2013 to 49,000 (94% reduction). Early diagnosis, meticulous and aggressive treatment initiating from the emergency room to the ICU may result in successful outcome with complete recovery.

Management of tetanus aims at eliminating the source of toxin (source control), neutralizing the unbound toxin, controlling spasms and other disease manifestations, managing complications, providing adequate ventilation, and supportive care.

To eradicate the vegetative cells, Metronidazole may be the preferred antibiotic although penicillin is still used frequently. In patients with a deep wound, thorough debridement and toilet is necessary to prevent spore germination.

Antitoxin is used to neutralize circulating toxin and unbound toxin in the wound. Intrathecal antitoxin has also been used in adults. This has been shown to improve survival if given in the early stages. Tetanus immune globulin (TIG) may shorten the course of tetanus and lessen its severity.

Convulsive spasm constitutes a medical emergency requiring early and effective treatment. Airway, respiratory, and circulatory support maybe needed and should be provided immediately. Many agents, alone and in combination, have been used to treat the muscle spasms of tetanus. Sedatives like diazepam and neuromuscular blocking agents are usually used. The ideal therapeutic regimen would abolish spasmodic activity without causing over sedation and hypoventilation. Magnesium sulphate is an attractive substitute and may be tried if mechanical ventilation facilities are unavailable. Baclofen directly stimulates postsynaptic GABA receptors blocked by tetanus toxin and may decrease the need for sedation and ventilatory support. As it does not cross the blood-brain barrier, intrathecal baclofen has been also used and reported in several small series with varying success. Autonomic dysfunction is difficult to manage and requires therapy with benzodiazepines, morphine, magnesium sulphate, adrenergic blockers and recently tried baclofen therapy. Supportive care including ventilatory assistance are essential for successful outcome of the patients. It is important that complications are diagnosed early and managed appropriately. Immunization is extremely effective and is the key to prevention. Adequate steps and measures should be taken to increase awareness of this potentially preventable disease.
LEPTOSPIROSIS

Juan Silesky Jimenez
Hospital San Juan de Dios, Caja Costarricense del Seguro Social / Hospital CIMA San Jose, Costa Rica

Leptospirosis is an infectious disease caused by pathogenic spirochetes of the genus Leptospira (derived from the Greek lepto or “thin” and spira or “coil”), for example, Leptospira interrogans. Twenty-one new species are catalogued with DNA reassociation that may be pathogenic to humans. The most severe presentation of leptospirosis was described by Adolf Weill in Heidelberg, Germany in 1886, and so it is known as Weil disease.

Leptospira can cause a mild nonspecific presentation or a severe one associated with multisystem compromise and high mortality. The organism has global distribution, mainly in tropical or subtropical regions with a humid and rainy climate. Its natural reservoirs are the kidneys of infected mammals, mainly rodents. Infection in humans occurs by direct contact with the tissue or urine of infected animals. Bacteria can enter through the conjunctiva, oral mucosa, intestinal tract, wounds or abrasions, with dissemination to the central nervous system, vitreous humor, lungs, heart, liver, and kidney. The bacteria can also produce vasculitis, which enables infection of all tissues.

The infection rate is considered to be underestimated because leptospirosis has a wide range of presentations and can be similar to a flu-like illness. It should be included in the differential diagnosis of a patient with a febrile syndrome in endemic or epidemic regions.

High clinical suspicion is the pivotal point for the diagnosis of leptospirosis. It can cause the following:

1. Mild disease similar to a flu-like illness.
2. Weil disease, characterized by jaundice, renal failure, bleeding, myocarditis associated with dysrhythmias.
3. Pulmonary hemorrhage and respiratory failure.
4. Meningoencephalitis and aseptic meningitis.

Clinical and laboratory study abnormalities will depend on the affected organs.

The leptospira incubation period is usually 10 days, but may vary from 5 to 14 days. Two phases are classically described:

1. Leptospiremic phase, during which bacteria disseminate through the bloodstream to the organs and body tissues, usually 5-7 days. Death is rare at this stage, and the symptoms may resolve.
2. Immunologic phase can start between day 4 and 30 after the initial phase and in which the maximal organ injury occurs; it can be fatal.

The most sensitive method is polymerase chain reaction, which can be helpful early in the disease development or as a confirmation tool.

Antibiotic treatment must be started as soon as possible (Table 1). These bacteria are very sensitive to antibiotic therapy with doxycycline, ampicillin, amoxicillin, azitromicin, Penicillin G, Ceftriaxone;

Jarisch-Herxheimer reaction has been described in patients have received penicillin and tetracycline.

The severe presentations of leptospirosis require monitoring and an approach to the affected systems that includes starting early and aggressive support measures. The recovery of infected patients is complete.
HANTAVIRUS

Jorge Sinclair
Punta Pacifica Hospital/Johns Hopkins Med. Panama

Hantavirus was first recognized as an infectious disease in the early 1950s when a cluster of 3,000 UN troops stationed in Korea was struck by a mysterious illness. Infection was associated with fever, hypotension, renal failure, thrombocytopenia, and disseminated intravascular coagulation. It became known as hemorrhagic fever with renal syndrome (HFRS), formerly Korean hemorrhagic fever, and the virus was named Hanta after the Hantaan River of Korea.

Hantavirus cardiopulmonary syndrome (HCPS), however, was not recognized until May of 1993, when an unusual illness struck a Navajo tribe living on the border of New Mexico and Arizona. Those infected presented with fever, chills, myalgia, and cough, which often progressed to dyspnea, respiratory distress, and cardiovascular collapse. An alarming 80% of those infected died.

The new virus went through before finally being given the somewhat tongue-in-cheek moniker of the clinical syndrome caused by Sin Nombre virus (SNV) became known as HCPS.

About 20 viruses have been identified within the genus Hantavirus, family Bunyaviridae, but only 11 have been shown to cause human disease. China has the highest annual incidence of HFRS with somewhere between 20,000 and 100,000 cases each year. Most cases are attributable to the Seoul virus, with the Hantaan virus playing a more minor role.

Five the New World Hantaviruses cause HCPS in North America, while a few others cause disease in Central America and South America. Most New World viruses cause HCPS. SNV is the prototypical New World Hantavirus and is the cause of the vast majority of cases of HCPS in the United States and South America.

International
Thirty-six cases of HCPS have been reported in Canada.
South America is the other major reservoir of HCPS. Confirmed cases of HCPS include 404 in Argentina, 74 in Paraguay, 273 in Chile, and 168 in Brazil. Bolivia had 20 cases; Panama, 31; and Uruguay, 23. Currently, at least 4 Hantavirus species in South America are recognized to cause HCPS. One of them, the Andes virus, is unique for reports of person-to-person transmission and of an increased mortality rate in children.

PATHOPHYSIOLOGY
Evidence exists that immune mechanisms rather than direct viral cytopathology are responsible for the massive vascular dysfunction.
Likely players include tumor necrosis factor-alpha (TNF alpha), interleukin 1 beta (IL-1 beta), and interferon gamma (IFN-gamma), though this has yet to be clarified.
In the case of HCPS, capillary leak is overwhelmingly centered in the lungs leading to fulminant non-cardiogenic pulmonary edema. Patients may progress quickly to cardiogenic shock with decreased cardiac output, elevated systemic vascular resistance, and lactic acidosis.
In the outbreak in Panama 1999, we found a close relationship between the mortality and the release of cytokines at the acute phase.

Pathology
Two new virus were discovered in the epidemic crisis in Panama. Choclo (Oligoryzomys fulvescens) and calabazo (Zygodontomys brevicuada) damaging the brain, myocardial cells, lungs and others sites.

Treatment
Hemodynamic support, mechanical ventilation, vasoactive drugs and high index of suspicion are the keys for the treatment of Cardio-pulmonary syndrome.
SEVERE DENGU INFECTIONS IN ICU

Shirish Prayag
Shree Medical Foundation, India

The incidence of dengue fever is increasing globally and especially in the developing world. According to WHO, case fatality of dengue fever is less than 1% when treated appropriately. There has been a steady increase in the incidence of severe dengue infection over the last 10 years in developing countries like India and more importantly overall mortality of severe dengue infection is reported between 15% to 19% in the published literature. The manifestation of Severe Dengue infections are varied and include Shock (either due to plasma leakage or hemorrhage), ARDS, Hepatitis, Encephalopathy, Myocarditis, Polyserositis and Coagulopathy. Our study published in 2011 showed that the development of multiple organ dysfunction in these patients is associated with higher mortality rates. Interestingly, amongst the organ dysfunctions, the non hematological organ dysfunction [ like Cardio vascular, respiratory and neurological ] were associated with a higher mortality as compared to hematological organ dysfunction.

A prospective observational study was conducted in 14 tertiary care ICUs across Pune, India in 2012-13. Out of the 113 patients included in the study, 30 [ 26.55% ] did not survive. Mortality was higher in patients with age >50, concurrent medical disorders. SOFA score at baseline was worse in Non survivors. Non-survivors had severe shock as demonstrated by various hemodynamic variables and need for mechanical ventilation (non-invasive or invasive) was higher in non-survivors. There were no significant differences in hematologic parameters except for higher prothrombin time (INR) in non-survivors. This study identified non hematologic organ dysfunction as a direct cause of mortality in severe dengue infection irrespective of the hematologic involvement. Possible role of lactates, ScVO2, Serum albumin, SOFA scores on admission and their deterioration was also studied.

By studying these factors causing high mortality in patients of dengue, appropriate treatment strategies need to be evolved. Traditionally high volumes of fluid especially colloids were used in these patients with shock, due to the leaky capillaries to combat the relative hypovolemia. Our future management strategies of this disorder with high mortality need to be titrated to appropriately analysed factors contributing to the high mortality.
CLINICAL PRESENTATION AND DIAGNOSTIC TOOLS -
COULD I DIAGNOSE EBOLA

Guy Richards

University of the Witwatersrand, South Africa

Ebola virus disease (EVD) is a filovirus endemic to West and Central Africa. It has ravaged 3 countries in West Africa recently and affected a number of other geographical regions in Africa, Europe and the USA.

Identification is critical as the risk of nosocomial transmission is greatest prior to diagnosis and prior to the use of appropriate personal protective equipment (PPE). Diagnosis is made by means of polymerase chain reaction but with specific reference to risk- namely potential for contact with the virus, including geographical areas visited, occupation (health care workers) and clinical features.

Prevention of spread requires strict adherence to infection control, use of and availability of PPE and education of the community regarding isolation of individuals and safe burial practices. These will be discussed in more detail in the lecture.
INFECTION CONTROL - WHAT ARE THE RISKS, WHAT WORKS

Halima S Kabara
Aminu Kano Teaching Hospital, Nigeria

The toxic mix of scientific ignorance and paranoia on display in the reaction to the return of health care workers from the front lines of the fight against Ebola in West Africa, the amplification of these reactions by politicians and the media, and the fear-driven suspicion and shunning of whole classes of people are all reminiscent of the response to the emergence of AIDS in the 1980s.

In its largest outbreak, Ebola virus disease spread through Guinea, Liberia, Sierra Leone, and Nigeria. The West African variant likely diverged from central African lineages around 2004, crossed from Guinea to Sierra Leone in May 2014, and has exhibited sustained human-to-human transmission subsequently, with no evidence of additional zoonotic sources.

The emergence of life-threatening infections such as severe acute respiratory syndrome (SARS) and re-emerging infectious diseases like plague and tuberculosis have highlighted the need for efficient infection control programs in all health care settings and capacity building for health care workers so they can implement them.

The world assumed that EVD was too efficient at killing its hosts, doomed to quickly burn out wherever it arose. The 2014 West African outbreak has changed everything. It was the Black Swan 2 the inevitable consequence we did not foresee.

Effective prevention and control of infectious agents must be embedded into everyday practice and applied consistently. Crucial to this is the identification of risk in healthcare practice and the adoption of measures to remove or control such risks.
RESEARCH PREPAREDNESS FOR PANDEMICS AND EPIDEMICS

Satish Bhagwanjee
University of Washington Medical Center, United States

Recent history has taught us that the world has become a “smaller” place. With modern travel the rapidity with which diseases are spread is exponentially greater than in ages gone by. At the same time we are challenged by natural and human threats that exceed our current ability both from the perspective of effective therapy and with respect to applying current resources effectively.

Several key signals emerge when this reality is dissected including:

1. The need for global collaboration in developing an acute care research agenda
2. The need to develop a common purpose that recognizes regional and cultural differences
3. The need for pilot projects that allow for testing of multiple strategies prior to an outbreak
4. Novel approaches to the use of current / future information technology to allow for rapid dissemination of data to prevent spread and to allow for choice of suitable therapy.
5. The need to broaden the base of care provision such that resource differences between regions/countries are accommodated.

Any effort to deal with this challenge requires a multi-country, multi-disciplinary approach that places human needs above competing interests of countries or individuals. Several initiatives are currently under way.

At the end of this presentation the attendee will be able to:

a. Understand the extent of the problem.
b. Recognize the elements necessary to develop the research agenda.
c. Identify the roles of countries and organizations.
d. Recognize current efforts / initiatives.
e. Be able to envision an individual / group role in moving this agenda forward.
EBOLA: CHALLENGES AND LESSONS LEARNED

Nahoko Shindo

WHO (World Health Organization), Switzerland
METABOLIC ACIDOSIS IN THE CRITICALLY ILL

Janice Zimmerman

Houston Methodist Hospital, United States

Metabolic acidosis is a common acid-base disturbance in critically ill patients that is often associated with worse outcomes. Clinicians must be able to recognize the presence of the acidosis, determine the etiology and implement interventions to treat the cause.

Three methods can be used to diagnose a metabolic acidosis: traditional (CO2/HCO3 and anion gap), base excess, and physicochemical (strong ion difference). The primary difference in the methods is how the metabolic component is analyzed. Limitations and advantages of each method must be appreciated to ensure appropriate evaluation. The traditional approach must take into account albumin concentration for accurate calculation of the anion gap (AG). For every decrease of 1 g/dL in albumin, a decrease of 2.5 to 3 mEq in AG occurs. Conversely in patients with significant alkalemia (usually pH > 7.5), albumin is more negatively charged, which increases unmeasured anions in the absence of an acidosis.

Metabolic acidoses are typically characterized as increased AG or normal AG (hyperchloremic). Causes of an increased AG acidosis are listed in Table 1. Normal AG acidoses are caused by gastrointestinal (diarrhea, ileostomy) and renal loss of HCO3 (renal tubular acidoses, hyperaldosteronism).

Table 1. Causes of an increased anion gap acidosis

<table>
<thead>
<tr>
<th>Cause</th>
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<tbody>
<tr>
<td>Renal failure</td>
</tr>
<tr>
<td>Toxins</td>
</tr>
<tr>
<td>Ketoacidoses</td>
</tr>
<tr>
<td>Acetaminophen</td>
</tr>
<tr>
<td>Diabetic ketoacidosis</td>
</tr>
<tr>
<td>Cyanide</td>
</tr>
<tr>
<td>Alcoholic ketoacidosis</td>
</tr>
<tr>
<td>Ethylene glycol</td>
</tr>
<tr>
<td>Starvation</td>
</tr>
<tr>
<td>Iron</td>
</tr>
<tr>
<td>Lactic acidoses</td>
</tr>
<tr>
<td>Isoniazid</td>
</tr>
<tr>
<td>L-lactic acidosis (type A and B)</td>
</tr>
<tr>
<td>Metformin</td>
</tr>
<tr>
<td>D-lactic acidosis</td>
</tr>
<tr>
<td>Methanol</td>
</tr>
<tr>
<td>Propofol</td>
</tr>
<tr>
<td>Propylene glycol</td>
</tr>
<tr>
<td>Salicylates</td>
</tr>
<tr>
<td>Toluene</td>
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<tr>
<td>Valproic acid</td>
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</tbody>
</table>

Type A lactic acidosis is the most common AG acidosis in the critically ill and is associated with inadequate tissue oxygen delivery. Type B lactic acidosis results from altered cell metabolism, increased aerobic metabolism or glucose production with enhanced pyruvate production, or inhibition of cytochrome oxidase. Drugs and conditions associated with type B lactic acidosis include dobutamine, epinephrine, etomidate, linezolid, lorazepam, malignancies, metformin, nucleoside reverse transcriptase inhibitors, propofol, tetracyclines, thiamine deficiency and valproic acid.
The clinical manifestations of metabolic acidosis may be difficult to distinguish from manifestations of the underlying disorder. Metabolic acidosis results in increased cerebral blood flow but mental status is often decreased. Pulmonary effects include an increase in minute ventilation, respiratory failure, pulmonary edema and increased pulmonary vascular resistance. Cardiovascular effects may include arrhythmias and a potential decrease in myocardial function or response to catecholamines. Acute acidemia enhances O2 unloading from hemoglobin by shifting the oxyhemoglobin dissociation curve. Other metabolic effects of metabolic acidosis include hyperkalemia, hypercalcemia, insulin resistance, and increased protein catabolism.

Correction of a metabolic acidosis always requires treatment of the underlying condition. Treatment of normal AG metabolic acidoses (hyperchloremic) involves replacing volume with a low chloride, bicarbonate-containing fluid. Interventions for increased AG acidoses include insulin for diabetic ketoacidosis, antidote for poisonings, discontinuation of a medication, renal replacement therapy and correcting hypoperfusion. Administration of bicarbonate and other buffers does not improve outcome from metabolic acidosis and can lead to adverse effects (volume overload, intracellular acidosis, hypokalemia, hypocalcemia). Some studies suggest that bicarbonate may improve myocardial responsiveness when the pH is <7.1 with severe hemodynamic instability. However, myocardial performance is often normal in metabolic acidosis.
RENAL FAILURE IN SEPSIS/SEPTIC SHOCK

Venugopal Reddy

Penn State Hershey Medical Center, United States

Early recognition of Acute Kidney Injury (AKI) in the intensive care unit (ICU) is very crucial. Indeed, AKI has become a major issue with rising incidence causing more than four million deaths per year worldwide. Sepsis alone accounts for nearly 20% of the incidence related to AKI. At present, the most widely used classification of acute renal failure is based on the RIFLE criteria (Risk, Injury, Failure, Loss, End-stage renal disease) proposed by the Acute Dialysis Quality Initiative group. Yet, the pathophysiology of septic acute kidney injury is still inadequately understood. During severe sepsis, in addition to overwhelming production of inflammatory humoral mediators and activation of cellular system, there is increased production of norepinephrine, renin-angiotensin aldosterone system (RAAS) with elevated levels of angiotensin II and a rise in vasopressin levels are often part of host response. Previous suggestions highlighting systemic hypotension, renal vasoconstriction, and ischemiareperfusion injury as the major mechanisms for septic AKI have been questioned by animal experiment.

The effect of sepsis on systemic vasculature is ultimately to cause reduction in mean arterial pressure. When mean arterial pressure falls below the auto-regulatory range renal vasoconstriction will occur. In experimental model of sepsis as well as in septic patients a wide variation in renal blood flow has been documented. Some studies have suggested AKI may also develop in hyperdynamic septic shock with preserved or even increased RBF.

The glomerular filtration rate is decreased in most forms of sepsis probably related to systemic hypotension. Cardiac Output (CO) is the most important independent predictor of renal blood flow in sepsis: if CO is increased, then RBF is typically increased; and if CO is decreased, the RBF is typically decreased. Vasoactive substances which are released during sepsis, and which cause preferential afferent constriction, include leukotrienes, adenosine, thromboxane A2 and endothelin.

Other mechanisms that have been proposed in sepsis induced AKI include organ cross-talk linking lung and kidney injury and microvascular dysfunction and heterogeneity in local renal blood flow resulting in areas of hypoperfusion and hypoxia, oxidative stress response, and alterations in cell energy consumption driven by mitochondria.
Acute kidney injury (AKI) is a common complication in intensive care unit (ICU) patients and is associated with substantially increased morbidity and mortality. In 2004, the Acute Dialysis Quality Initiative (ADQI) group defined AKI as abrupt (1 to 7 days) and sustained (> 24 h) reduction in kidney function, and formulated the Risk, Injury, Failure, Loss, and End-stage kidney disease (RIFLE) classification. Since then, a large body of literature has been published, to describe the association between RIFLE and clinical outcome.

However, limitations of RIFLE criteria have also been acknowledged, including ignorance of biomarkers with better predictive value, imbalance between creatinine and urine output criteria, difficult determination of baseline creatinine and/or GFR, inaccuracy in estimated GFR in a situation of rapid change in renal function, and very small creatinine change which is associated with poor outcome. In particular, the effect of baseline creatinine level on the diagnosis and mortality of AKI has been demonstrated by several studies.

As a result, in 2007, Acute Kidney Injury Network (AKIN) published revised diagnostic criteria for AKI. In comparison with RIFLE criteria, it replaced Risk, Injury, and Failure with stages 1, 2, and 3, where increase in creatinine as small as 0.3 mg/dl was categorized as stage 1. Moreover, AKIN criteria removed Loss and End-stage renal disease, as they should be used to describe chronic renal outcome. GFR criterion was also removed, due to the aforementioned difficulty in accurate assessment. More specifically, AKI diagnosis was based on a change between two creatinine values within a 48-hour period, rather than the proposed timeframe of 1 week as specified in RIFLE criteria. Last, but not the least, AKIN diagnostic criteria should be used only after an optimal state of hydration has been achieved.

Few studies have examined the diagnostic accuracy between RIFLE and AKIN criteria, concluding that AKIN criteria may slightly improve the sensitivity of AKI diagnosis, without significant improvement in mortality prediction compared with RIFLE criteria.

The acknowledged limitations of AKIN criteria include diagnosis based on pathophysiologically late clinical parameters, confusion about the reference creatinine, the 48-hour timeframe (for AKI diagnosis), and the 1-week timeframe (for AKI staging), and difficulty without daily creatinine measurement (especially in general wards). However, more debates focus on issues related to urine output criteria, which remain the same as previously stated in RIFLE criteria. Current literature suggested poor agreement between AKI stages based on creatinine and urine output criteria. In addition, the predictive validity of urine output criteria has been shown inferior to creatinine criteria (both RIFLE and AKIN). Interestingly, Solomon and the colleagues found that significantly more junior physicians working in the ICU, than the ICU patients they cared, met the urine output criteria according to RIFLE.

In conclusion, AKI is a common and often fatal clinical syndrome in ICU. Recent consensus definition of AKI represented an effort to standardize the definition and diagnosis, in order to improve clinical outcome and clinical research.
DYSNATREMIA IN ICU

Georges Offenstadt
Hopital Saint-Antoine, France

Dysnatremia
Natremia belongs to the toolbox of the practicing intensivist. Because it is an indicator of the hydration status.

In medical ICU of Saint-Antoine Hospital in Paris in 2014, among 915 ionograms at admission, 10.6% indicated hyponatremia (130 mmol/L), 1.6% were 120 mmol/L and 1.4% were 150 mmol/L.

I - Physiopathology
Water diffuses freely across cell membrane, driven by plasmatic tonicity. Cells shrink in case of extracellular hypertonicity, and will expand with hypotonicity. These changes in volume are tempered in brain cells, since they have a particular system for changing their osmotic content.

Regulation of plasmatic tonicity results from thirst, renal excretion of water and release of anti diuretic hormone (ADH).

II Clinical aspects and etiology of hypo-osmolar states
In most patients, hyponatremia is asymptomatic, because the decrease in natremia is a slow process allowing brain volume cells to adapt. Acute hyponatremias are less frequent than chronic hyponatremias and worse tolerated.

Diagnosis depends on the history, clinical examination and basic biochemical data. Urine samples are as important as plasma samples for the diagnosis.

A - Eliminating iso or hyperosmolar hyponatremia
The first step consists in confirming that hyponatremia is hypotonic.

Hyponatremia may be associated with hyperosmolar state, the most frequent cause is hyperglycemia.

The second step is to assess the renal response to hypotonicity. Is renal dilution capacity normal but exceeded by a too large input of water? In this case, the ratio of urine osmolality to plasmatic osmolality is below 1 or < 150 mosmol/L, suggesting potomania.

If the ratio is above 1, diagnosis will depend on the state of extra-cellular hydration. Natriuria is very important in this respect.

Hypotonic hyponatremia will be considered in association with hypovolemia, euvoelema or hypervolemia.
III Clinical aspects and etiology of hyperosmolar states

The constitution of an hyperosmolar state requires an inadequate water intake.

Hyperosmolar states without hypertonicity

Hyperosmolar states without hypertonicity must be eliminated. It is the case when there is an increase of extracellular solutes, like urea or ethanol, diffusing to the intracellular space.

Hyperosmolar states with hypertonicity

- Loss of water almost free of electrolytes (polyuria of diabetes insipidus if not compensated
- Loss of water and electrolytes (osmotic polyuria complicating hyperglycemia).

Gains of non diffusible electrolytes (hyperglycemia).

IV - Treatment

The main goal of the treatment is not to normalize numbers, but to treat symptoms. Tolerance must always be appreciated.

Mathematical formulas proposed are of interest for a better understanding, but should not be followed strictly.

Hyperosmolar state

Rehydration is always necessary. The oral route should be favored because it easily allows pure water replacement.

Hypoosmolar state

Rapid correction (1 to 5 mmol/L/h) is only indicated in patients with severe symptoms (seizure, coma). Treatment is based on injection of an average 2g NaCl/h, possibly associated with loop diuretic, cautiously monitored and stopped as soon as the symptoms disappear.

Most of the time, chronic hyponatremia is well tolerated. Correction has to be slow taking into account the risk of appearance of the osmotic demyelination syndrome.
DYNAMIC NUCLEAR INTERACTIONS BETWEEN INFLUENZA VIRUS AND ITS HOST

Yumiko Imai

Akita University Graduate School of Medicine, Japan

The influenza virus is a single-stranded negative-sense RNA virus, and transcription and replication of the virus genome occur in the nucleus. Viral infection is generally associated with virus-driven hijacking of the host factors including the ones involved in the nuclear virus-host interactions. Using lipid library screen and lipidomics analysis we have identified novel lipid mediators and metabolic pathways, which can suppress influenza virus replication via NXF1-mediated viral RNA nuclear export machinery, suggesting a link of host metabolites and metabolic pathway to nuclear virus replication mechanism. In addition, a glowing body of work has shown that environmental stress can control chromatin structures that closely correlate with transcriptional regulation. Very recently, we found that influenza virus disrupted stable chromatin organization mediated by histone lysine methylations, which controls virus replication mechanisms in the nucleus. These data suggest a crucial role of dynamic nuclear virus-host interaction in the pathogenesis of influenza virus infection, which could be a novel target for anti-influenza drugs.
GLOBAL COLLABORATION IN CRITICAL CARE RESEARCH

John Marshall

University of Toronto, St. Michael’s Hospital, Canada

The landscape of critical care research has changed profoundly over the past quarter century. Whereas earlier clinical research studies were dominated by industry-led studies or by small single center trials, there has been a striking trend much larger trials led by dedicated investigator-led clinical research groups. The first of these was the Canadian Critical Care Trials Group (CCCTG), founded in 1989 to promote collaborative and investigator-led research into the best care of critically ill adults and children. The CCCTG served as a model for similar collaborations elsewhere, and in 1994, researchers in Australia and New Zealand formed a sister organization, the Australia and New Zealand Intensive Care Society (ANZICS) Clinical Trials Group. Similar groups have been formed in the United States, the United Kingdom, throughout Europe, in Brazil, and in China, and sister groups are emerging in Latin America, India, Singapore, and sub-Saharan Africa.

Catalyzed by the 2009 H1N1 influenza pandemic, some 20 of these investigator-led consortia joined forces to conduct collaborative pandemic research under the banner of the International Forum for Acute Care Trialists (InFACT). InFACT currently has two dozen member organizations committed to promoting large scale clinical research collaboration, and to enabling research through promoting common metrics and outcome measures, mapping global capacity for acute care, educating and mentoring the next generation of acute care researchers, and raising the profile of investigator-led research with funders and decision-makers. This model of investigator-led research has proven successful. Studies conducted by formally structured trials groups are cited three times more often than studies conducted by industry or by independent investigators, and represent many of the landmark studies of critical cares.

The global reach of SARS and H1N1 in the early 21st century, combined with new technologies that facilitate communication and data capture, have resulted in new models of research collaboration that emphasize large scale engagement and open access data management. They promise to transform acute care clinical research.
WHAT WE LEARNED FROM RCTS IN CRITICAL CARE MEDICINE

Jean-Louis Vincent
Erasme Hospital, Université Libre de Bruxelles, Belgium

The prospective randomized controlled trial (RCT) is considered as providing the highest level of evidence for (or against) an intervention. However, in the intensive care unit population, RCTs can be challenging to conduct, largely because of problems identifying homogeneous patient populations for study inclusion. This is particularly true for multicenter trials targeting mortality. Thus, despite often well-designed and conducted trials, using interventions based on sound rationale and promising pre-clinical and preliminary clinical data, RCTs targeting mortality in critically ill patients have rarely demonstrated any beneficial effects on outcomes. When patient groups in a study of any intervention are too heterogeneous, some patients in each randomized group will inevitably benefit from the intervention but others will be harmed by the same intervention, so that overall there will be no difference in outcome. This effect has occurred repeatedly in RCTs in ICU patients, particularly in those with sepsis, a condition with no specific criteria or markers making identification of homogeneous study groups particularly difficult. Very few RCTs in ICU patients have actually demonstrated an impact on mortality outcomes, leading to widespread adoption of the intervention. One such study was the trial of high versus lower tidal volume, which demonstrated the benefits of protective ventilator strategies. One may argue that negative RCTs can also help improve patient management and contribute to progress in this field. Negative trials encourage investigators to explore the reasons behind the (often unexpected) negative findings, which can help improve our understanding of the pathophysiology and mechanisms of disease. Understanding the limitations of RCTs in this setting has also helped improve trial design and created an interest in developing alternative study types and placing more weight on results from observational or non-randomized studies. Ongoing studies are starting to look at organ function as an end-point and/or select patients on the basis of biomarkers. We have learned that the traditional ICU, hospital or 28-day mortality endpoints are not necessarily the most relevant and other endpoints must also be considered in the challenging ICU environment.
CRITICAL CARE IN SOUTH AFRICA

Dean Gopalan
Nelson R Mandela School of Medicine, University of KwaZulu Natal, South Africa

The objective of the presentation is to familiarize listeners with the state of critical care services in South Africa. The model of ARDS will be used to demonstrate the various important issues pertaining to the delivery of critical care.

South Africa remains an extremely vibrant yet diverse country, a diversity that is essential to our identity as a Rainbow Nation. Yet, it is this very diversity that is equally challenging as it is a country that is diverse in terms of its geography, its people, its health care facilities, and its disease profiles and patterns.

An overview of the situation will be presented illustrating data from our National Audit. There is a distinct difference between the public and private practice situations. About eighty percent of the population seek care in the public sector in which about 20% of the health care spend occurs. South Africa performs particularly poorly in terms of its Gini coefficient. Most of the private units still function as open units while those in the state sector are closed.

Generally there is a distinction between adult, paediatric and neonatal intensive care units. Only in large academic centres, are there distinct units for different disciplines. Patient loads are massive with the increasing infectious disease burden (HIV and TB) impacting greatly.

Infrastructure challenges are major, especially in rural areas. Effective patient transport to and between health centres is problematic. Rural areas have challenges of water and electricity. Inadequate facility design and size impact effective care. Aging equipment, drug shortages, failing laboratory services and dwindling personnel numbers and expertise all place great strain on a stretched system.

Ethical issues unique to the South African context will be described. There is a distinct focus on primary and secondary over tertiary levels of care. The realities of decision making mean that triaging, even of patients that may be otherwise salvageable, is commonplace. The lack of family support and presence impacts consultative approaches. Traditional and cultural health practices also play a role.

The training of health care professionals will also be covered. Critical Care remains an area of subspeciality training with examinations and certification. Nurse training is also a big focus area.

Despite these challenges, the critical care fraternity remains a close-knit and effective group delivering high quality health care.

There is no easy walk to freedom anywhere, and many of us will have to pass through the valley of the shadow of death again and again before we reach the mountaintop of our desires. Nelson R Mandela
How ICUs Look Different between Countries?  

MANPOWER AND THE ECONOMY IN ICU, AND THE INDONESIAN PERSPECTIVE

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At the start of this national survey in 2010 done by our Indonesian Society of Intensive Care Medicine with the Department of Health in 33 provinces. Found 1047 registered government hospitals which are divided in class C for primary services and B for secondary and A for tertiary services that already have or will have an ICU. Existed are 276 and more icus to be operational soon. Further report early 2013 : 314 already operational. Those without an ICU are lower facililies and not in this survey. The spread of this hospitals also concentrated in 2 mayor areas. Manpower to coordinate this icu is regulated by a Department of Health Regulation consist of Intensivist,anesthesiologist,other specialist as well general practitions who are appointment based on this regulation. This helped a lot to reduce unnessesarry expences.

Basic salary for an icu physician start from 120 USD as a GP and almost double for a specialist. Many physicians are timely scheduled to stay on those certain type C location. For type B and A (referral hospitals) the physicians are requested to be fulltime appointed with a specific remuneration scheme based on InaCBG. Sofar all have a high idealism to work and improve the services in their icu or stabilized the patient to be transfered to a referral hospital.
ICU QUALITY IMPROVEMENT STRATEGIES IN THAILAND

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Intensive care unit is the area allocated to resuscitate seriously ill patients. It is characterized by high level of care, high technology, high expectation, high utilization and high demand. Quality is thus needed in order to ensure the best clinical outcomes and optimal utilization of resources. Like other areas in clinical medicine, quality improvement model maybe categorized into 1. structure of care, 2. process of care and 3. outcomes of care. Ability of patients with indication for admission to access to care and to and patients experiences are also included in critical care quality domain.

Hospital accreditation in Thailand has been operated for 20 years; under government agency, the Hospital Accreditation (HA) institute. Conceptually, this is a voluntary process which is aimed for continuous self improvement. At first, health care facilities are asked to review their goal, the process of care and their performance. Then, continuous quality improvement processes are implemented accordingly. The accreditation was granted after external peer survey from the HA institute (HAI). There was certain scoring system for different level of achievements. At the moments, all hospital in Thailand have been in different levels of accreditation. Some are in process for applying higher standards, namely TQA or JCIA. Quality improvement in critical care flows along the main theme while focusing more on patient safety; for example, the quality of emergency response, patient care process, medication safety, caring of tubes and lines and effective infectious control.

Apart from the accreditation by HA system, a bottom up process has been promoted. Currently, ICU personnel from various hospitals team up a group called ICU community of practice (ICU COP) under the sponsorship of HAI. Here, they share experiences and collaborate certain target works; for example, the surviving sepsis project which has been a tremendous success and the work for benchmarking quality indicators.

In conclusion, strategies to improve ICU quality, in our experience, direct toward maximizing clinical outcomes by accreditation system which requires the employment of CQI concept. The combination of this top down policy with and bottom up community works may boost up the process.
SEVERE SEPSIS IN ASIA - CAN WE DO BETTER?

Jason Phua  
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Given that Asia is the largest continent in the world, it is unsurprising that a huge variation in available health-care resources exists across its many countries. Unfortunately, sepsis remains one of the biggest killers in Asia, and it is likely that many of its victims would not have succumbed had they received more timely and appropriate medical care. This talk gives an update on the state of our war against sepsis in Asia and asks if we can do better.
VALIDATION OF APACHE II AND SAPS II IN BANGLADESH

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A prospective observational cohort study was conducted between Jan 1 2008 and Dec 31 2008 in the ICU of a 600 bed tertiary care non profit postgraduate hospital of Bangladesh and between Oct 1 2008 and Dec 31 2008 in the ICU of a 200 bed private hospital of Bangladesh.

Objective of this study was to assess the performance of Acute Physiology and Chronic Health Evaluation II (APACHE II) and Simplified Acute Physiology Score II (SAPS II) to predict the probability of mortality in a well defined ICU patient cohort in Bangladesh.

A total of 328 ICU admissions were screened for study in these two hospitals. Out of them 194 subjects fulfilled study criteria. There were 58 deaths (42.65 %). APACHE II and SAPS II predicted hospital mortality as 35.32 ± 21.81 and 37.11 ± 27.34 respectively. Both models showed excellent discrimination. The overall discriminatory capability as measured by the aROC was generally good and ranged from 0.78 to 0.89. Although APACHE II had a greater aROC, suggesting that it had slightly better discriminative power than SAPS II, both models had aROC values less than 0.8 [a ROC 0.75,CI(0.67-0.82)for APACHE II and 0.74,CI(0.66-0.81)for SAPS II].

The APACHE II and SAPS II model also exhibited good calibration shown by calibration curves and Hosmer-Lameshow goodness-of-fit test (=8.304 with p=0.40, and =9.040, with p=0.34 respectively).

Based on our findings we were unable to show a significant superiority of one scoring system over the other as both models performed equally well in our ICU subjects. Our observed mortality was similar to the predicted mortality from both scoring systems, which suggest that the result of this study revealed good intensive care quality. We believe that both these two models could be used in Bangladesh ICUs. However these models may require appropriate adjustment to reflect more precisely the mortality in our ICU patients. Although generalizing our results to all Bangladesh ICU patients would be risky, we believe that our study population represents a reliable reflection of our specific clinical conditions. We need further prospective validation studies on a larger Bangladeshi ICU population before a firm conclusion can be made.
VALIDATION AND CUSTOMIZATION OF SAPS 3 SCORE IN KOREAN ICU PATIENTS

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ICU scoring systems are needed to stratify patients by their probability of hospital mortality, to measure performance, to decide resource allocation and to aid in the clinical management. Outcome prediction scores were first developed some 35 years ago. These scores are not designed for individual prognostication but can be useful in many aspects of patient care and ICU management. But to accurately predict mortality using these models validation and customization is needed due to local patient mix and characteristics and also change in diagnostic and treatment modalities may affect performance of the model.

SAPS 3 is the latest of the Simplified Acute Physiologic Score (SAPS) series first published in 2004. In 2011, Korean Study Group on Respiratory Failure (KOSREF) did a multi-center study involving 15 centers across Korea. In all 4428 patients were randomly assigned to Development Set and Validation Set. SAPS 3 showed good discrimination power with aROC curve = 0.85. But SAPS 3 had poor calibration with over-estimating mortality in Korean population. A first level customization of SAPS 3 was performed to adjust the model and Logit equation for Korean SAPS 3 was derived from the Development Set. This customized equation was validated in the Validation Set with good discrimination (aROC curve = 0.84) and good calibration (Hosmer-Lemeshow GOF test p>0.05).

SAPS 3 had good discrimination but poor calibration in Korean ICU patients. Korean SAPS 3 equation was developed and validation.
MDR BACTERIA IN ICU: FROM ICU OR FLOOR

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Multi-drug-resistant organisms (MDRO) are increasingly common and are considered to be a challenge for clinicians, especially in intensive care units (ICUs). However, critically ill patients are more vulnerable to infections with MDR bacteria. Therefore, ICU may be a department in which MDR bacteria concentrate, but not a place where produce MDR bacteria. We prospectively screen our patients from different department at their ICU admission and discharge. MDRO were defined as bacteria were resistant to at least three antimicrobial classes, such as methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococci (VRE), Pseudomonas aeruginosa, Acinetobacter baumannii. 610 patients were included, we found that 225 (37%) were colonized or infected with MDR bacteria at ICU admission and increased to 51% when patients were discharged. The proportion was various in patients came from different departments, and in some department with high consumption of antibiotics such as respiratory medicine, nearly half patients were colonized or infected with MDR bacteria at ICU admission. As antimicrobial exposure is a very important factor which induces bacteria drug-resistant, we performed a pre-post study to confirm the effects of this policy on MDRO in critically ill patients. We included the our patients from June 2010 to May 2011 and from June 2012 to May 2013. Bacterial cultures were conducted at ICU admission and discharge. In June 2011, our hospital started to administer the antimicrobial stewardship program of Chinese MOH. We collected the data on antimicrobial consumption during the 3-year period in all hospital and individual department every month, and analyzed the correlation between the proportion of critically patients colonized or infected with MDRO and antimicrobial consumption. A total of 978 patients were involved in the present study. With the intervention, the monthly mean Defined Daily Dose (DDD) per 100 occupied bed-days throughout the hospital decreased from 96±7 to 65±6 (p<0.001), and the proportion of patients colonized or infected with MDRO decreased from 36% to 13% at the time of ICU admission and declined from 48% to 29% at the time of ICU discharge (both p<0.001). These results showed that the MDRO isolates was very high in ICU, however, more than half were come from the wards.
**AEROZOLIZED ANTIBIOTICS**

Massimo Antonelli

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Nebulization of antibiotics has been proposed to achieve bactericidal concentrations of antimicrobials (especially colistin and aminoglycosides) at the alveolar level in patients with MDR GNB VAP. Inhaled antimicrobial aerosols produce high drug levels in the lungs without increasing the risks of systemic toxicity and the emergence of MDR gut microflora. The efficacy of this approach has been demonstrated in cystic fibrosis but its value in the treatment of GNB VAP is less certain.

The studies that have explored the possibility are generally quite small, and have produced conflicting results.

In a large homogeneous cohort of patients with VAP caused by colistin only susceptible (COS) A baumannii, P aeruginosa, or Klebsiella pneumoniae has been assessed the efficacy and safety of aerosolized (AS) and IV colistin therapy compared with IV colistin alone. Compared with the IV colistin cohort, the AS-IV colistin cohort had a higher clinical cure rate (69.2% vs 54.8%, P = 0.03) and required fewer days of mechanical ventilation after VAP onset (8 days vs 12 days, P = 0.001). In the 166 patients with post-treatment cultures, eradication of the causative organism was also more common in the AS-IV colistin group (63.4% vs 50%, P = 0.08).

In critically ill patients with VAP caused by MDR GNB, the combination of aerosolized and intravenous colistin can significantly improve clinical cure rates and reduce the need for MV without increasing the risk of AKI.

THE MANAGEMENT OF BIOFILM FORMATION IN INVASIVE FUNGAL INFECTIONS

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Nosocomial invasive candidiasis is a major problem, associated with significant mortality that affects 15% of nosocomial infections in patients hospitalized in intensive care units (ICUs). Candidemia is frequently associated with the colonization of medical devices, such as catheters while the alteration of skin and mucus barriers caused by the use of medical devices (catheters, probes, intubation, etc) is considered also as a factor that is generally predisposing to invasive candidiasis in the ICU.

Candida spp, mainly C. albicans, are characterized by the ability to create biofilm, a structure of highly adherent microbial cells, tolerant to antifungal agents and the host immune response and considered as a persistent root of infection disseminating infectious cells to other locations. Biofilm, can be developed on abiotic surfaces acting as reservoirs of pathogenic microorganisms while over half of all hospital infections are originated from these microbial communities. Biofilms are surrounded by a selfderived extracellular matrix while several cell wall proteins have been shown to play crucial role during their formation such as glyco-phosphatidylinositol (GPI)-anchored agglutininlike cell wall proteins, hyphal wall protein Hwp1, Ywp1(Pga24), Eap1 (Pga47), Pga26, Pga1 and members of the CFEM family (Pga10, Rbt5 and Csa1).

Today, there is an increasing evidence that Staphylococcus aureus (prokaryotic pathogen) and Candida species (eukaryotic pathogens) can be act as co-infector microorganisms leading to a strong biofilm formation with increased antimicrobial tolerance and higher mortality rates. This polymicrobial biofilm community is caused by different synergistic, mutualistic, and antagonistic interactions between the microorganisms while the secretion of specific degradative enzymes can be highlighted as one of the most significant involved in colonization and infection processes.

The activity of antifungals against biofilm vary among different agents. Fluconazole and azoles, static against Candida are not active against sessile forms while echinocandins and amphotericin B offer both bactericidal activity and good penetration into biofilms.

References

"FIRST COME, FIRST SERVE"?

Charles Sprung

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The demand for critical care exceeds supply and rationing of ICU beds is common (1,2).

When less ICU beds are available, fewer patients are admitted and patients admitted are more severely ill (1). Patients and families are willing to undergo intensive care for a one month survival (3) and intensivists admit patients with no hope of surviving more than a few weeks (4).

Although severity scoring systems were developed for prognosticating ICU mortality, there is only one for ICU triage (5). In triage studies, non-admitted patients had a higher mortality than admitted patients (2,6-8). The greatest benefit is for patients in the middle illness severity range (6,7) and recommendations state patients too well or too sick to benefit should not be admitted (9-11).

Unfortunately, indications for ICU admission and discharge remain poorly defined. What criteria should be used to make these difficult life and death decisions? SCCM guidelines (11) state: triage decisions should be made explicitly, without bias and ethnic origin, race, sex, social status, sexual preference or financial status should never be considered. For criteria for specific patients, SCCM recommended using medical benefit (9) whereas ATS recommended first come, first serve (10). SCCM used a utilitarian approach providing the greatest good for the greatest number. ATS used the principle of justice- if everyones life is equally valuable, patients meeting thresholds for medical need should be admitted on a first-come, first-served basis (10). Recently, a consensus of experts re-assessed the original SCCM recommendations (12). Respondents unanimously agreed that triage decisions should not be made on a first come, first served basis (12). They also recommended that: patients with a greater likelihood of benefit have priority over patients unlikely to benefit, priority for admission to an ICU should correlate with the likelihood that ICU care will benefit the patient substantially more than non-ICU care, patients with very poor prognoses and little likelihood of benefit should not be admitted to ICUs and that patients with little or no anticipated benefit from further ICU treatment may be discharged or transferred from the ICU (12).

References

RULE OF RESCUE OR GREATEST GOOD FOR ALL

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Background/Purpose (introduction)

Despite the enormous resources spent for the delivery of healthcare worldwide, there sometimes is a profound discrepancy between the need for and the provision of health services. Unfortunately, this is also the case concerning patients in need of life-sustaining treatments in intensive care units (ICUs) (1). Subsequently, treatment options in ICUs, often referred to as ICU-beds, sometimes need to be triaged or even rationed. Despite the proposition of various triage rules hitherto (1-3), there seems to be no unanimous resolution regarding the tussle for the last ICU bed. One common notion seems to be, though, that identifiable severely ill patients are prioritized over potential (not yet admitted) patients for whom substantially more benefits could be achieved. Does this choice hold ethical reasoning?

Methods

The rule of rescue, intended to exclusively benefit an identifiable patient, and the principle of utilitarianism, intended to sustain rather many patients, albeit with smaller benefits, are revisited with regards to the role of physicians in the allocation of scarce resources.

Results

Given the indispensability of triage regarding the admittance of patients to ICUs, there seems to be a general understanding that ICUs should be reserved for those patients who have a reasonable prospect of substantial recovery (1). Also, by general principles, there seems to be consensus that patients with very poor prognoses and little likelihood of benefit should not be admitted to the ICU, that access for marginally beneficial ICU care can be restricted on the basis of high cost relative to benefit, and that there may be circumstances when it is justified to discharge a patient from the ICU to admit another patient (1, 2). But the application of such general principles to tangible patients could not be consented (1). Specifically, clinicians still seem to prefer treating identifiable patients with dire prognoses, without bearing in mind the ensuing opportunity costs, over caring for potential organ donors, for example, whose organs might result in many more life-years gained, however for yet unidentified patients (4).

Conclusions

The duty to rescue regarding both individual professional and institutional rescue measures is not without limits to scope and extent by ethical reasoning (1, 5). A purely deontological approach would neglect the societal value of consequentialism, whereas puristically implementing distributive justice would forego the potential benefit of extended individual rescue efforts. Reasoning about and acting upon justice in health care seems of very little relevance in clinical decision-making, though, perhaps because tangible results of treatment in identifiable patients is of more relevance to most clinicians than are potential benefits for yet unidentified persons. Although this appears intuitively comprehensible, it is not set in stone, ethically speaking.
Literature


Keywords

Triage, Utilitarianism, Rule of rescue
PROGNOSTICATION

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In the context of triage prognostication is complex, and evidence to support the many components of prognostication sparse. Triage can be fairly achieved in more than one way, but the use of the principle of justice, modified as distributive justice is frequently invoked in resource limited settings. The principle of distributive justice suggests that certain patients may be preferentially admitted to ICU. Prioritizing by preferential admission of patients that will benefit most, aims to achieve the most medical benefit for the greatest number of patients with the limited available ICU resource. It must, however, be recognized that patients refused admission will, in most instances, have an increased attributable mortality 1.

To achieve maximal medical benefit from ICU admission, it is necessary to balance incremental benefit from ICU (medical outcome) with incremental cost (resource utilization). Incremental benefit requires a measure of prognosis if admitted to ICU, but also a measure of prognosis if not admitted so that incremental benefit can be estimated. Costs should be similarly evaluated. Data allowing these incremental benefit and cost estimations to be made are very limited, and rarely available in a form that would inform decision making at the point of ICU admission. Scoring systems have potential, but current models have been shown to have relatively poor discrimination and are not adequate for routing clinical use. The use of ethically sound principles and objective and transparent processes to guide clinical decision-making apparently remains the best currently available method of achieving consistent informed decisions based on distributive justice. Prognostic data is sparse, but should be collated and research to improve the evidence base for prognostic decisions encouraged.
REPORT OF THE TASK FORCE OF THE WFSICCM: TRIAGE

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BRAIN DEATH: DEATH OR NOT

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Death is defined as a permanent cessation of the functioning of the organism as a whole, which is determined by showing (1) the permanent cessation of circulatory and respiratory function (cardiorespiratory death) and (2) the irreversible cessation of all brain function (brain death). The concept of brain death was newly developed since the advent of modern intensive care facilities in mid 20th century, which was initiated by the report of Coma Dpasse by Mollaret and Goulon (1959) and further defined by Ad Hoc Committee of Harvard Medical School (1968). In 1970, Kansas became the first state of the USA, who adopted brain death in her statute. The Presidents Commission of USA (1981) wrote Uniform Determination of Death Act, which was widely accepted by most countries worldwide for their official and legal recognition of brain death as death.

Despite the prevailing practices of brain death worldwide, there are still significant controversies about the concept of brain death with occasional introduction of lawsuits related to brain death in Newspapers with subsequent generation of hot public debates. Although most medical professionals acknowledge that brain death is equivalent to cardiorespiratory death, the public recognition of brain death as death is still limited and widely variable. In addition, one of major public concerns is related to the intimate link between brain death and organ transplant program. Although most public members are willing to donate their organs for the benefit of others, the actual incidence of organ donations from brain-dead patients has been relatively small and static. Apparently, the timing of procurement of vital organs from patients pronounced brain-dead seems quite a sensitive issue for families who think their loved-one is still alive before the complete cessation of heart beating under mechanical ventilation. In addition, public at large do not know that the declaration of brain death and the organ procurement are independent, separate processes with appropriate safeguards being installed to separate the two process apart.

To improve public confusion related to brain death and organ donation, well designed educational programs and research required for a wider public acceptance of the concept of brain death.
DONATION AFTER CIRCULATORY DEATH

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The ethics of organ transplantation have been premised on the dead-donor rule, which states that vital organs should be taken only from persons who are dead.

Criteria for declaring patients death while their organs still alive were developed under the dead-donor rule. Neurologic criteria are demonstration of cessation of brain function with no possibility to resume while circulatory criteria are demonstration of cessation of circulation and breathing with no possibility to resume.

The distinction between DBD (Donation after Brain Death) and DCD (Donation after Circulatory Death) lies in the method of determination of death. DCD is determined as the death by circulatory criteria, which derive in the irreversible cessation of circulation and breathing. On the contrary, DBD is determined as irreversible loss of brain function by neurologic criteria. DCD is ethically adequate because organ donation is proceeded after patients death under the dead-donor rule.

International workshop focused on DCD was held in Maastricht in 1995. DCD donors were classified into two main categories: (1) uncontrolled donors: dead on arrival (category I) or unsuccessful resuscitation (category II); and (2) controlled donors: awaiting cardiac arrest (category III) and cardiac arrest in a brain-dead donor (category IV).

The practice of DCD has increasingly become a part of transplant programs all over the world. In Netherlands, 37% of all donors were DCD donors and in UK, 29% of all donors were DCD donors in 2013. Within Eurotransplant, 10% of all kidney transplantations were from DCD kidney in the 2013. Although kidney transplantation is the main part of using DCD organs, the boundaries are increasing to liver, lung, and islet transplantations.

In Spain, only 8.8% of the donor pool consist of DCD donors nationwide, they have developed a well-established DCD programs. Spanish model is developed for uncontrolled DCD programs by using a well-trained, well-equipped, and motivated out of hospital emergency organization system. The medium-and long-term graft survival of kidney transplantation as well as acute rejection rates do not differ between DCD donors and DBD donors.

But DCD programs seems to be difficult to develop. Many obstacles should be solved such as technical, legal, ethical and an important organizational problems before the initiation of program since support from the public is the key component for the successful settlement of DCD program.
CONTROLLED WITHDRAWAL OF LIFE SUPPORT IN A DONOR CANDIDATE: ETHICALLY ACCEPTABLE?

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Estimates may vary, but there are over 100,000 people in the United States waiting for a transplant. In 2011, 23,747 transplants were performed of which 18,813 were from deceased donors and 4,934 from living donors. (http://www.statisticbrain.com/organ-donor-statistics/Statistic Brain Research Institute) Twenty one people die every day while waiting for an organ transplant; one organ donor can save 8 lives and change the lives of more than 50 people. (http://www.transplants.org/facts-about-organ-donation)

The majority of recipients are waiting for kidneys, and while an important and undoubtedly cost-saving and quality of life best alternative to the dialytic therapies currently available, nonetheless, the majority of the current discussion will focus on transplantation of organs necessary to sustain life in the absence of viable biological or mechanical alternatives; i.e. liver, and heart transplantation. It is in this arena that ethical dilemmas abound based on the viability and functionality of the organ to be transplanted after the donors natural death. Given the ephemeral nature of any organ in the absence of functional preservation, early transplantation focused on living related procedures that naturally led to biologically compatible procedures utilizing paired organs that left the donor with acceptable (usually undiminished) residual organ function. Subsequently, partial liver transplantation evolved, again permitting donation from related or compatible donors. While innovative, the ethical considerations in these areas are subdued.

However, the extension of the argument leads to the focus of this discussion and the evolution of new theories of death that permit the extirpation of organs from a heart beating cadaver without transgressing any overt moral code against harvesting an organ that causes the death of the donor. While discussions of brain death are outside the scope of this discussion, those interested should refer to a series of articles published in the Journal of Critical Care Volume 29 Issues 4, 5, and 6, 2014 and Volume 30, Issue 1, 2015) The crux of the ethical dilemma surrounds the concept Primum non (nil) nocere - often attributed (mistakenly) as a direct quotation from the Hippocratic Oath but nonetheless reflective of its meaning that prohibits a physician from taking the life of a patient. Over time, the requirements for and mankind’s philanthropic nature to preserve life led to a necessity to refine the concept of natural death in order to support successful transplantation programs. Indeed, this concept is reinforced by the current nature of the discussion framed in the context of donation.

Current western philosophy, ethics and organized religions support the concept of a definition of death in an organ beating body with no measurable/meaningful supratentorial cerebral function. However, the problem for this discussion is whether it is permissible to withdraw life support in a donor candidate to reach an acceptable donation state. This will be one of the questions under discussion during the panel presentation; it is likely to be a debate rather than a dissertation.
APPROPRIATE RECIPIENT WITH ONE SINGLE ORGAN FAILURE UNDER INTENSIVE CARE

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Organ transplantation is the best available established technique for the treatment of end stage failure of most essential organs (liver, heart and lungs). People of every age give and receive organ transplants. However approximate 21 people die every day waiting for transplants that can’t take place because of shortage of donated organs. An average 1 million people world-wide have benefited from successful organ transplantation. A number of transplant patients have survived well over 25 years and five years survival rates for most organ transplant programmes are around 70%. With modern techniques of organ preservation and advances in immuno-suppression, a significant proportion of patients can now expect to achieve long-term survival with a high quality of life.

Many more people could benefit from organ transplantation than receive transplants at present. There are currently nearly 40,000 patients waiting for a kidney in Western Europe. Mortality rates for patients waiting for a heart, liver or lung range between 15 and 30%, i.e. 400 plus die waiting for an organ each year. These figures do not represent the true position. Because of the chronic shortage of organs, some transplant clinicians are extremely selective about the patients they put on the waiting list. Currently only those patients most likely to benefit will be even considered for transplantation.

The critical factor is the supply of organs for transplantation. Only good quality organs are likely to function satisfactorily and there are strict limits on the time that can be taken to retrieve and transplant the organ. In practice this means that, for most organs, only relatively young donors are suitable who are admitted into intensive care units and subsequently declared brain dead so that organs can be retrieved while the donors heart is still beating. A typical donor has suffered either a road traffic accident or a severe cerebrovascular accident. Due to improvements in road safety in European countries, donors in the former group are in decline. Kidneys are somewhat less sensitive to ischaemia (shortage of oxygen).

In view of the potential for successful transplantation, it is considered essential that countries with an organ transplant service, take all possible measures to ensure that all potential donors are identified and as many as possible converted into effective donors.

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IS TOTAL PARENTERAL NUTRITION “POISONOUS”?  

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TPN was developed at the end of the 1950s its use increased rapidly in the 1960s to 1970s. Unfortunately, as a result, TPN administration was associated with over-feeding and related metabolic disorders, leading to increased morbidity & mortality.

In the past 20 years, studies extensively showed that TPN could induce:

1. metabolic disorders (hyperglycemia, hypertriglyceridemia)
2. liver steatosis
3. endocrine dysfunction
4. impairment of immunity
5. infections
6. increased mortality

Intestinal mucosal atrophy, leading to bacterial translocation from the gut to the bloodstream, was proposed as a theoretical complication of PN.

Numerous studies have shown that EN was insufficient to cover protein and energy requirements.

Why PN Needs To Be Reconsidered in ICU Patients?

1. In daily practice, achieving targeted nutritional goals with EN is often difficult
2. EN is frequently interrupted in ICU patients for multiple and recurrent events
3. Initiation of EN is often delayed because of concerns about gastrointestinal intolerance (eg, vomiting, diarrhea, abdominal distention) and dysmotility (gastroparesia, ileus), which occurs in as many as 46% of patients
4. Insufficient EN delivery is also seen because of inaccurate medical prescriptions

The concept of early EN, based on an excellent physiologic approach, is often associated with failure to achieve energy targets. Therefore, during the early phase after ICU admission, a negative proteinenergy balance is frequently observed and cannot be compensated for later. The provision of early TPN (up to 48 hours) to patients with absolute or relative contraindications to enteral nutrition does not alter mortality. Additionally, there is no consistent evidence in critically ill patients suggesting that early TPN improves the number of ventilator-free days or length of stay in the ICU or hospital. In balance, evidence suggests that early TPN in well-nourished critically ill patients, whether given as the sole therapy or supplemental to EN, does not reduce mortality and may be associated with an increased risk of nosocomial infections. The optimal time for starting parenteral nutrition in critically ill patients is unknown. There is considerable controversy here the European Society of Parenteral and Enteral Nutrition (ESPEN) suggests that TPN should be started around 48 hours in the critically ill. The American Society of Parenteral and Enteral Nutrition (ASPEN) suggest that TPN should be started after 7 days in the critically ill.
The primary goal of nutrition support therapy is to supply the substrate necessary to meet the metabolic needs of patients in whom adequate nourishment cannot be provided by mouth. These needs vary with the phase of critical illness. Optimizing nutritional therapy is based on fully understanding the premorbid nutritional status of the patient and the pathophysiology of the underlying critical illness. The enteral route is preferred in most circumstances, but there are specific situations, in which TPN is necessary and may be beneficial.
HOW EARLY IS ‘EARLY’ IN ENTERAL NUTRITION?

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Royal Prince Alfred Hospital, Australia

Early institution of nutritional support in critically ill patients is now recognised as a standard of care. In published guidelines, early institution is generally defined as by the enteral route and within 48 hours of ICU admission, whereas if enteral feeding is not possible parenteral feeding, if considered, can or should be delayed. The deleterious effects of nutrition deprivation occur very rapidly in illnesses associated with a catabolic response (such as burns, trauma and sepsis), however, with the development of an energy debt that when incurred is repaid very slowly. Animal work shows that even in acute sepsis provision of nutrients is associated with amelioration of the decreased muscle protein synthesis that is characteristic, and a reduction in protein breakdown. Doig and colleagues (Intensive Care Med, 2009) in a meta-analysis showed that commencement of enteral nutrition within 24h of admission was superior to delay, and in the Canadian nutrition guidelines study (Martin et al, CMAJ 2004) commencement of nutrition by any route just 12 hours earlier was associated with improved clinical outcomes. Haemodynamic instability and inotrope use does not appear to be a contra-indication to commencement of nutrition support. Current best practice would therefore appear to be to institute nutritional support in critically ill patients as soon as possible following ICU admission.

Multiple surveys and reports however have shown that even with best intention most patients are underfed to targets when the enteral route is used exclusively early in critical illness. This poses the question whether parenteral nutrition should be commenced early in patients that cannot tolerate enteral nutrition, either instead of or as a supplement to the enteral feed. This question has been the subject of a number of major clinical trials reported in recent years. Each of the trials has been subtly different in design, and in combination these trials have added significantly to our understanding and our ability to make recommendations regarding best practice. Overall, the evidence suggests that parenteral nutrition is safe to commence early in all patients that require nutritional support, but should not be administered to patients that will be discharged from the ICU in under 3 days or will be eating soon. Parenteral nutrition probably adds little benefit (although does not cause harm) in patients that can be fed enterally, even if targets cannot be achieved. This finding obviously brings up the question of what is a minimal acceptable target for enteral nutrition when the calculated target cannot be achieved. Some recent work has suggested that even trophic enteral feeding (~10mL/h) is similarly efficacious to full enteral nutrition in terms of clinically relevant outcomes, however as yet there is insufficient data to make confident clinical recommendations.

In summary, therefore, current best practice is to commence enteral feeding as soon as possible on ICU admission in any patients expected to stay >3 days. When enteral nutrition is not possible, parenteral nutrition can be used safely, however there is probably no significant benefit of supplementing enteral feed with parenteral. Optimum feeding targets currently remain undefined.
IS HYPOCALORIC FEEDING BENEFICIAL?

Pierre Singer  
*Rabin Medical Center, Israel*

Large audits show that in daily practice, calories are prescribed around 1,800 to 2,000 kcal/day but are administered at amounts varying between 1,200 and 1,450 kcal/day, not reaching the current recommendations issued by ESPEN or ASPEN/SCCM. Many observational studies have demonstrated the association between negative energy balance (the difference between energy expenditure and administered calories during ICU stay) and outcome. More infection, more complications, a longer ventilation and ICU stay are observed as well as a higher mortality. However, prospective randomized studies comparing target calorie administration to underfeeding failed to show an advantage for the target feeding in most of the studies. Many limitations are reducing the validity of these studies. First, the calorie requirements are based on predictive equations that have been shown to be of poor accuracy. Second, there is a large gap between the prescribed calories and the administered calories, making the study groups underfed as well as the control group. It is then more understandable to not find any difference between an underfed and an more underfed group. Third, since the calorie administration is using standard ready to use commercial preparation, this results in a lower protein administration. This low protein administration is per se associated with poor outcome.

The only studies using measured and not predicted energy expenditure evaluations (1) are also the only one showing outcome improvement. The TICACOS study shows an increased morbidity but also an improved hospital survival in the per protocol group. The SPN study is adding supplemental parenteral nutrition to ICU patient failing to reach the calorie target and a measurement of their requirements is done at day 3. The patients receiving the adequate energy had lower rate of acquired infections. Finally ICU patients receiving not only adequate energy according to indirect calorimetry, but also protein intake according to recommendations had a better survival.

We are lacking large studies comparing patients receiving adequate energy and protein intake according to guidelines to underfed patients. Only these studies will let us know if there is an advantage for hypocaloric feeding.

WHY PROTOCOL?

Hyun Wook Baik

Daejin Medical Center, Bundang Jesaeng Hospital, Republic of Korea
ENTERAL FEEDING PROTOCOL

Masaji Nishimura

Takushima University Graduate School of Medicine, Japan

Nutritional support provides calories, protein, electrolytes, vitamins, minerals, trace elements, and fluids. Major goal of nutritional support is to facilitate recovery from critical illness. However, nutritional needs in the critically ill are poorly understood. Many ICUs use a feeding protocol, however there is tremendous variability in the protocols.

Enteral nutrition preserves gut immune function and reduction of inflammation, and considered to reduce infectious complications in critically ill patients. Whether early enteral nutrition decreases mortality in critically ill patients is uncertain. Clinical practice guidelines recommend enteral nutrition as the preferred route for nutritional support with early initiation when possible. However, neither the length of hospital or ICU stay, nor hospital or ICU mortality differs between early and late initiation of enteral nutrition. The necessary volume of enteral nutrition required to maintain intestinal integrity remains unknown. A large volume of enteral nutrition is a risk factor of aspiration. Once enteral nutrition is started, mortality does not differ according to administered calories. On the contrary, achieving 100 % caloric goals in the first week of critical illness may be harmful.

In the critically ill patients, muscle proteins are broke down into amino acids to serve as the substrate for gluconeogenesis. Some data suggest that providing at least 80% of prescribed amount of protein is associated with improved clinical outcomes, however adequate amount of protein is controversial. Recommendation of protein intake of ASPEN and ESPEN is not same. There is growing concern that over prescription of protein may have detrimental impact on outcomes.

Mortality and morbidity are influenced not only by the route, volume of nutrition and protein, but also nutritional status of patients themselves (malnourished, well-nourished, or obese), and their underlying diseases. Therefore, there have been controversial in the nutritional support for critically ill patients. For now, initial nutritional goal may be 8 to 10 kcal of calories/kg per day and then 18 to 25 kcal and 1.5 grams of protein/kg per day after five to seven days.
GLUCOSE CONTROL PROTOCOL

Pierre Singer
Rabin Medical Center, Israel

If hyperglycemia has been linked to increased morbidity and mortality in the ICU, prospective interventional studies designed to examine the effectiveness of tight glucose control have given conflicting results. The definitive optimal glycemic target is still not defined, but this discussion has created a consensus regarding the importance of preventing large hyperglycemias, moderate (<60 mg/dL) and severe hypoglycemia (<40 mg/dL) and large variability that all have been associated with significant morbidity. Protocols have therefore been designed to limit the rate of hypoglycemia and to decrease variability. Control of glucose variability appears to be the key feature of optimizing outcome in hyperglycemic patients. A plenty of proprietary and non-proprietary protocols to manage glucose in the ICU have been published and some of them are available on web sites, but there is no accepted uniformity in glucose control algorithms. According to Wilson (1), the ideal insulin infusion protocol should achieve glycemic control in a reasonable timeframe, with minimal hypoglycemia, low operator error rate, and minimal nursing time required. Each center should choose his protocol according to the type of patient. Protocols should incorporate bolus doses, adjust for the direction and rate of glucose decline and permit off-protocol adjustments. Definitively, one protocol fits all is not the best approach.

HOW WE TOOK ON MERS: SMC ICU EXPERIENCE

Gee Young Suh
Sungkyunkwan University School of Medicine, Republic of Korea
MERS-COV OUTBREAK IN KOREA: AN INFECTIOUS DISEASE SPECIALIST’S PERSPECTIVE

Sang-Ho Choi  
Asan Medical Center, University of Ulsan College of Medicine, Republic of Korea

Outbreak summary: The index patient was a 68-year-old Korean business man who had travelled to 4 countries in the Middle East region. Seven days after returning to Korea, he had fever and myalgia. It took 10 days to diagnose Middle East respiratory syndrome coronavirus (MERS-CoV) pneumonia. A cluster of 38 confirmed MERS-CoV infection cases was directly or indirectly associated with index patient. Considerable number of exposed patients were moved to other healthcare facilities and brought about subsequent large clusters. As of July 26, 2015, a total of 186 laboratory-confirmed cases of MERS-CoV infection has been identified.

Microbiology: The viral genetic sequencing studies of MERS-CoV didn’t reveal significant changes that relate to enhanced transmissibility of the virus. Droplet and contact transmission appear to be the major mode of transmission. Therefore, at present, pathogenicity and virulence of MERS-CoV looks generally similar to those reported from Middle East region.

Patients: The interim analysis of characteristics of 186 patients are summarized in the Table. Vast majority of cases were acquired MERS-CoV in the nosocomial setting. Thirty-nine patients (21.0%) were health care worker. Four super-spreader (patient #1, #14, #16, and #76) transmitted MERS-CoV to 151 patients (81.1% of 186 patients). At the time of admission, pneumonic infiltration was evident in about 60% of patients. No child case was identified. Old age (> 50 yr) was a significant risk factor mortality (data source: preliminary data from Korean Society for Infectious Diseases).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number (%), total n=186</th>
<th>Variable</th>
<th>Number (%), total n=186</th>
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<tbody>
<tr>
<td>Male</td>
<td>111 (59.7)</td>
<td>Median incubation period</td>
<td>6.8 days</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>54.6 (16.3)</td>
<td>Phase of infection</td>
<td></td>
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<tr>
<td>Health care worker</td>
<td>39 (21.0)</td>
<td>1' infection</td>
<td>1 (0.5)</td>
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<tr>
<td>Acquisition</td>
<td></td>
<td>2' infection</td>
<td>30 (16.1)</td>
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<tr>
<td>hospital</td>
<td>179 (96.2)</td>
<td>3' infection</td>
<td>124 (66.7)</td>
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<tr>
<td>ambulance</td>
<td>2 (1.1)</td>
<td>4' infection</td>
<td>23 (12.4)</td>
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<tr>
<td>Household</td>
<td>3 (1.6)</td>
<td>uncertain</td>
<td>8 (4.3)</td>
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<tr>
<td>uncertain</td>
<td>2 (1.1)</td>
<td>Super-spreader</td>
<td>4 (2.2)</td>
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<tr>
<td></td>
<td></td>
<td>Overall mortality</td>
<td>36 (19.4)</td>
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<td>Factor</td>
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<tr>
<td>Social factor (medical structure)</td>
<td>Universal health insurance coverage</td>
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<td></td>
<td>Fee-for-service payment system with low health care fees</td>
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<td>Regional inequalities in access to health care system</td>
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<td></td>
<td>No gate keeping to higher level service</td>
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<td></td>
<td>Low proportion of public hospitals (&lt; 10%)</td>
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<td>Cultural factor</td>
<td>Strong preferences to large famous hospital and rapidity</td>
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<td>Custom of friends/relatives’ hospital visit</td>
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<td></td>
<td>Hospital stay of family members</td>
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<tr>
<td>Infection control measures</td>
<td>Improper hospital-room remodeling led to poor room ventilation</td>
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<tr>
<td></td>
<td>Use of air-conditioner at the hospital room</td>
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<tr>
<td></td>
<td>Non-optimal infection prevention and control measures</td>
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<td></td>
<td>Limited numbers of infection control professionals/infectious diseases</td>
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<td>expert</td>
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<tr>
<td>Outbreak investigation and response</td>
<td>Incomplete contact tracing of exposed patients, guardians, visitors, and</td>
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<td></td>
<td>health care workers</td>
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<td></td>
<td>Movement of possibly exposed persons</td>
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<td></td>
<td>Limited number of epidemiological expert</td>
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<td></td>
<td>Government secrecy about the names of hospitals where MERS-CoV infection</td>
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ARE WE READY FOR THE NEXT PANDEMIC?

Jean-Louis Vincent  
Erasme Hospital, Université Libre de Bruxelles, Belgium

The recent and ongoing pandemic of Ebola virus disease in West Africa has led many hospitals and governments worldwide to look at their healthcare systems to see whether they are equipped to handle a similar pandemic should it occur on their doorstep. The limited medical and infection control infrastructure and resources in West Africa have assisted in the spread of the virus and in the high associated mortality rates. The extent of the outbreak and threat of transfer beyond the African continent somewhat belatedly mobilized the international community. But what lessons can be learned from this human disaster? Are we as physicians ready for the next pandemic wherever it may occur? Are our hospitals and ICUs ready to manage large numbers of patients with serious, infectious disease? Recent outbreaks of severe acute respiratory syndrome (SARS) and H1N1 influenza put considerable pressure on ICUs in areas where most patients were infected. What do we do when pandemics are complicated by severe respiratory failure and our respirators and ECMO systems are all utilized? Local, regional, national and international plans of action need to be established, if not already done so, and reviewed regularly to insure they remain current and relevant. These plans need to include decisions on who should be responsible for initially assessing, triaging and treating patients; which hospitals should be allocated as key receiving centers for the most seriously ill; how to increase laboratory facilities to be able to cope with increased samples and provide rapid diagnostics; and how to mobilize sufficient staff and equipment to ensure satisfactory treatment for all who need it. Infection control practices also need to be regularly reviewed to insure they are adequate to prevent spread for contagious pandemics. With a more global outlook, we must try and improve medical structures and facilities worldwide so that we are better prepared when the next pandemic occurs. As the current outbreak of Ebola slows, we must not allow ourselves to become complacent. Planning for the next pandemic must continue and must involve closely coordinated input from all the multiple partners likely to be involved.
COLLABORATION FOR FUTURE PANDEMICS

Nahoko Shindo

WHO (World Health Organization), Switzerland
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Nursing Session (WFCCN)
A GLOBAL VIEW OF CRITICAL CARE: PRACTICE, POLICY AND POLITICS

Gerald Williams
World Federation of Critical Care Nurses, Australia

Since the early 1970s critical care practitioners have used this World Congress as a platform to share and celebrate their achievements, thoughts and aspiration for the professions. From those early times the WFSICCM has been the umbrella organisation driving the critical care agenda through its member organisations. At the 4th World Congress in Tel Aviv in 1985 critical care nurses started to raise their voice and profile in the hope that their contribution to the clinical practice agenda could be heard and seen. However it was not until 2001 that the World Federation of Critical Care Nurses (WFCCN) was born in Sydney Australia and critical care nursing started to identify itself as a true and mature partner in the relationship.

Informed by evidence and driven by passion, WFCCN now commands a strong place in the world of critical care and health care generally, invited to and present on many global advisory and policy making boards.

Every four years WFCCN conducts an international study of critical care nursing organisations (CCNOs) to identify the activities, issues and concerns of CCNOs and to inform the direction, policies and priorities of critical care professions and other health policy makers. The themes remain relatively constant: staffing levels, access to quality education programs, access to clinical guidelines and protocols and teamwork. Emerging issues now show differences between regions and countries with low economic status, something we must remain sensitive to in the developed world.

Trends in critical care nursing issues, concerns and priorities are presented from the last 4 studies spanning 16 years of consultation, research and publication to help understand where our profession now finds itself with respect to practice, policy and politics in 2015.

THE FUTURE OF CRITICAL CARE NURSING: PRACTICE ADVANCING GLOBAL CRITICAL CARE NURSING

Ruth Kleinpell

Rush University College of Nursing, United States

Improving critical care nursing practice is the first step in advancing global critical care nursing. Through a scoping review of the literature, a number of opportunities for advancing critical care nursing become evident: ensure adequate staffing in the ICU; recruit and retain qualified nurses; promote a healthy ICU workplace environment; provide access to continuing education; ensure safety in the work setting for patients and staff; advocate for policy to support the profession of critical care nursing, among other priority areas.

Seminal work by Benner and colleagues has identified nine domains of critical care nursing practice. These include (1) diagnosing and managing life-sustaining physiologic functions in acutely ill and unstable patients, (2) skilled know how of managing a crisis, (3) providing comfort measures for the acute and critically ill, (4) caring for patients families, (5) preventing hazards in a technological environment, (6) facing death: end-of-life care and decision making, (7) making a case: communicating clinical assessments and improving teamwork, (8) patient safety: Monitoring quality and preventing and managing breakdown, and (9) skilled know how of clinical and moral leadership and the coaching and mentoring of others.

Identifying priority areas of nursing to advance global critical care practice, education, and research is an essential component in identify strategies for the future of critical care nursing practice. At this Critical Care World Congress in Seoul Korea, country members of the World Federation of Critical Care Nurses (WFCCN) will be meeting to review and set an agenda for critical care nursing practice, education, and research. Rank ordering of recommendations identified in the literature and through international critical care nursing focus groups will be used to designate priority areas, taking into consideration country specific variations in practice and education.

As designated by the WFCCN 4th international survey on critical care nursing, important issues continue to challenge critical care nursing including those pertaining to wages, work hours, staffing, and educational needs. Identifying priority areas for clinical practice, education, and research will provide vital information to assist with the formulation of international strategies that can advance critical care nursing on a global level. It will also help guide nursing leaders and policy makers to address the needs of critical care nurses and their patients.

The results of this international critical care initiative will be disseminated via publications and presentations, and ongoing applications to clinical practice, education and research will be tracked. The work will be used to set a roadmap for further defining the future of critical care nursing practice, education and research and in advancing global critical care nursing.
EXPERIENCES OF INTER-PROFESSIONAL LEARNING IN A CLINICAL SETTING ON THE ICU IN STOCKHOLM

Eva Barkestad  
Danderyds Hospital, Sweden

Teamwork is essential in the intensive care unit (ICU). The critical ill patient is treated and cared for by different health care professions every day. All of them have different duties and tasks. They have different roles in the team. In the best of worlds the different healthcare professions and providers work side by side, collaborate and communicate with each other to give the critical ill patient optimal treatment and nursing care. There are studies showing that effective collaboration influence the outcome for critical ill patients both in mortality and length of stay. There is also evidence that lack of communication and collaboration in the team can have an effect on incidences and occurrence of presence of pressure ulcers, and ventilator associated pneumonia. Students from different health care professions have participated in an Interprofessional education (IPE) on a general ICU on a hospital in Stockholm. The students participated in a clinical setting for four consecutive days during their work placement. The students came from different programs: undergraduate nursing student, registered nurses training for their postgraduate education as critical care nurses and doctors during their residency. Focus in this program has been on collaboration, professional roles, responsibilities, communication, training of decision-making and professional skills.

The purpose to introduce this program of IPE is to alter attitudes and promote collaborative work between students in different healthcare professions. The learning outcomes of this bedside training program is to enhance the student knowledge and skills, practise communication and collaboration, letting them plan and undertaking a job and accomplish it together and understand the different roles and responsibilities in the health care team. The assessment of this IPE was summative and formative. The student scored this Inter professional learning in an audit with a mean of 8-10. The evaluation from used was modified from Ripleys scale. The formative assessment is followed up by interviews. The analyse with interviews with content analyse is an on going process.
HOW TO ENCOURAGE EARLY MOBILISATION IN ICU

Eva Barkestad
Danderyds Hospital, Sweden

Promoting early mobilisation in ICU

Literature supports physical therapy and early mobilisation in the ICU. Many systems are severely affected by immobilisation and mobilisation has documented effect on critical illness. ICUs all over the world are heavily staffed and consist of different healthcare professions with different working schedules. The patient and staff meet new teams every day. Under these circumstances it is important to do and visualise an implementation strategy with a purpose to encourage mobilisation at the ICU.

The aim with our project was to implement early mobilisation with critical ill patients admitted to our ICU. Individual daily goals were set according to the patient’s ability. This presentation will take you through the different steps we did to achieve our goal and change from heavily sedated patients to more awake and how we changed practise and today mobilise our patient in the ICU. Among other things to achieve our goal we implemented a mobilisation scale and prescribed daily goals. The preliminary results from our follow up show a positive trend of early mobilisation even with patient with multi organ failure and in need of life support.
EARLY MOBILITY: IMPACT SHORT AND LONG TERM OUTCOMES

Kathleen Vollman

ADVANCING NURSING LLC, United States
QUALITY OF LIFE AFTER DISCHARGE FROM INTENSIVE CARE

Younjung Son
Soochunhyang University at Cheonan, Republic of Korea

The purposes of this longitudinal follow-up study were to describe change in symptom experiences, functional status and health-related quality of life (HRQoL) and to identify the role of symptom experiences and functional status on HRQoL of Intensive care units (ICU) survivors after discharge from adult ICU. Patients who admitted in ICU for treatment their medical-surgical problems for a period of greater than 24 hours were included. Patients surviving to ICU discharge were approached for written consent to participate in this study. Total 213 patients during the study and of these 158 survived to 6 months following ICU discharge. Demographics, psychological factors (anxiety, depression) and situational factors (social support) were surveyed. Symptom experiences, functional status using the K-MBI (The Korean Version of Modified Barthel Index) and HRQoL with EQ-5D (Euroqol-5 Dimensions) were assessed at discharge, 1, 3 and 6 months after discharge from ICU. Data were analyzed using PASW 18.0.

As results, symptom experiences, functional status and HRQoL respectively improved predominantly within the first 1 month after ICU discharge. In hierarchical linear regression, this study showed that ICU survivors after ICU discharge, demonstrated a statistically significant association between symptom experiences, functional status and HRQoL at 1,3,6 months after ICU discharge adjusted for socio-demographic, disease-related, physical and psychological variables. Symptom experience and functional status explained respectively about 31%, 43%, 33% of total variance in HRQoL at 1, 3, 6 months after ICU discharge.

The symptom experience, functional status, and HRQoL of ICU survivors showed steady improvement, and the symptom experience and functional status continually acted as main influencing factors of HRQoL. This information may guide clinicians in their discussions with patients, families, and other providers as they decide on what treatments and interventions to pursue, especially within a month after ICU discharge.
PSYCHOLOGICAL RECOVERY AFTER ICU

Leanne Aitken

Princess Alexandra Hospital & Griffith University, Australia and City University London, United Kingdom

Critical illness, requiring admission to intensive care (ICU) affects millions of people worldwide each year. Although more than 90% of these patients survive their critical illness, many will experience protracted and problematic recovery with significant ongoing burden and economic cost on the individual, family, health care system and society. Aspects of recovery that may be compromised include physical or functional, psychological, cognitive, economic and quality of life components.

Psychological compromise after critical illness includes anxiety, depression and symptoms of post-traumatic distress. There is growing evidence that between one quarter and one half of critical illness survivors experience each of these problems, with many patients experiencing multiple aspects of compromise. Importantly, survivors experience varying levels of these symptoms at different time points in their recovery. Factors that have been identified as being related to psychological recovery include age, sex, socio-economic status, psychological history, cause of illness, length and type of treatment and ICU length of stay. Potentially modifiable factors that affect recovery include sedation practices, mobility and early psychological status.

Interventions to improve psychological recovery after critical illness might be delivered at multiple points including while the patient remains in ICU, after the patient has left ICU but remains in hospital and after leaving hospital. Strategies to be considered within ICU can be considered in three groups: (1) adapt ICU to limit the detrimental effects; (ii) introduce programs of care within ICU to improve long term recovery; (iii) identify ‘at risk’ patients to refer for additional support.

Interventions to be introduced within the ICU should incorporate limiting the harmful effects of care, for example those associated with excessive sedation or not effectively managing pain, as well as introducing new interventions such as counselling. Sedation has repeatedly been suggested as influencing long term outcome, although effective strategies to improve care in this area have proved elusive. Strategies that lead to sedation minimisation are essential and may need to be individualised to the specific clinical context and conditions within each ICU as well as each individual patient.

Screening for patients most likely to benefit from interventions is not undertaken routinely in most centres. Challenges associated with screening include the different psychological problems and different recovery pathways that people experience after their critical illness. Consequently, identifying a reasonably simple, yet effective, screening instrument may be difficult although early work in this area is promising.

Interventions commenced in the ICU should be expanded to the post-ICU setting to consolidate benefits and adapt to ongoing changes in survivors’ recovery. Interventions such as counselling and the use of diaries have been proposed, and implemented in some settings, although evidence demonstrating effectiveness and confirming lack of harm remains elusive. Consequently, research overcoming the methodological limitations and confirming proposed benefits is needed before strategies such are these are implemented into routine clinical practice. Development of any intervention to improve the psychological health of survivors of critical illness must involve effective communication and collaboration with many different colleagues from the multi-disciplinary team who practice across the care continuum.
WEB SERVICES FOR A REAL-TIME CONVERSATION WITH FAMILY MEMBERS OF ICU PATIENTS

Junghoon Choi
Sungkyunkwan University, Samsung Changwon Hospital, Republic of Korea

In fact, there is only one day in the intensive care unit control section 2 visits (11:30, 19:00). Especially towards the end of visitation 19:00 and is very curious about patient safety to the next day morning visiting hours. This has provided a SMS message everyday nursing services to patients safety to 8:00 a.m. to 9:00.

The short message service is the constraints occurred in the communication to inform patients only safety one-way communication method. System was upgraded to a two-way real-time communication methods to solve problems. If you provide nursing services to patients safety message patient’s family by using the Web server is generated real-time conversation program in EMR. After nurse to the patient family may provide a real-time care services in message. The nursing service has contributed to improve the reliability of customer satisfaction and medical team.
CONVERGENCE BETWEEN IT AND INTENSIVE CARE

Sung Soo Kim
Yonsei University Health System College of Medicine, Republic of Korea

Patient care is improving with application of digital health, and information technology convergence with healthcare is inevitable in the field of intensive critical care. Initially digital technology is introducing as a supportive tool for healthcare. Now digital healthcare technology is essential for safe and efficient patient care. Vital signs, I&O, and medical records are digitalized by healthcare IT system, and many treatment devices are more delicately controlled by IT. Real-time communication and synchronization of specialists opinion became possible by smart mobile technology. In addition to patient monitoring, we have to pay attention on analyzing data from intensive care unit and applying its results (and knowledge) to improve the quality of critical care. Reviewing current status of digital technology application and future domain of ICT convergence in the field of intensive care is an important part for the journey to save the life.
HEMODYNAMIC MONITORING - BASIC MANAGEMENT OF PATIENTS WITH ACUTE CORONARY SYNDROME WITHIN THE ICU

Youngae Kang
Asan Medical Center, Republic of Korea

Acute coronary syndrome (ACS) is a condition resulting in an imbalance between myocardial oxygen supply and demand.

1. Pathophysiology

With high levels of low-density lipoproteins (LDLs) circulating, they began to accumulate in the collagen fiber of intima of arterial wall, developing into an atheroma and plaques. Abnormal smooth muscle cells migrate from the media to the atherosclerotic intima, ultimately form a tough fibrous cap. As fibrous cap becomes thinner by cytokines, it eventually ruptures, and inner cells display tissue factors, a potent pro-coagulant, initiating the activation of the coagulation cascade. This chemical step releases platelet activating factors, thromboxane A2 and glycoprotein IIb/IIIa receptor on the platelet surface exposes fibrinogen binding site. Fibrinogen builds bridge to adjacent platelets and fibrin reinforces platelet aggregation; a thrombus is formed. The thrombus obstructs blood flow in the area of the affected coronary artery, resulting in an acute coronary syndrome.

2. Monitoring

1) 12-lead ECG monitoring

The electrocardiogram is the classic diagnostic tool used in ACS. The ECG is most helpful for diagnosis of ischemia or infarction when the ST segment and T wave are evaluated and the presence of a Q wave. Changes on ECG in patients with non-ST elevation ACS include ST depression, transient ST elevation or new T wave inversion. The ECG can be relatively normal or initially non-diagnostic.

2) Serum cardiac biomarkers

The most common laboratory tests used are creatine kinase (CK) and troponin. These markers are proteins released into the blood as a result of muscle destruction. Isoenzymes of CK reflect tissue origin: CK-MB is predominantly cardiac muscle. CK-MB starts to rise in 4 to 8 hours and peaks in 12 to 24 hours. Cardiac troponins are the most sensitive and specific biomarkers. They rise within a few hours of symptom onset and typically remain elevated for several days (may remain elevated for up to 2 weeks).

3) The monitoring of hemodynamic parameter and cardiac output

Hemodynamics is the study of the motion of blood and includes the assessment of a patient’s heart rate, pulse quality, blood pressure, capillary refill, other parameters. As the complexity of the patients status increases, invasive hemodynamic monitoring may be utilized to provide a more advanced assessment and to guide therapeutic interventions. Invasive hemodynamic monitoring is now used routinely in critical care and include waveform and numeric data derived from the central veins, right atrium, pulmonary artery, left atrium, or peripheral arteries.

The pulmonary artery catheter is equipped with a thermal filament between proximal port and distal end of the catheter. Heat impulses are transmitted every 30 to 60 seconds, and blood temperature changes are measured. The monitor displays continuously the average cardiac output obtained data. It is availability of up-to-data on which to base clinical decisions and interventions.
HEMODYNAMIC PROFILE ANALYSIS: A SYSTEMATIC APPROACH

Sandra Goldsworthy

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Management of hemodynamic monitoring in critically ill patients is a foundational competency for critical care nurses. Since pulmonary artery catheters are not commonly seen in current practice, the management of these lines is considered a high risk/low frequency skill. This presentation will provide a practical step-by-step approach to analyzing and understanding the numbers in a hemodynamic profile. Cardiac output determinants preload, afterload, contractility and heart rate will be illustrated using a systematic approach applied to case based scenarios.
NURSING CARE FOR THE ARRHYTHMIA PATIENTS IN ICU

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1. The subject

The most important thing of nursing care is ICU cardiac arrhythmia monitoring. In addition to monitoring, emergency coping skills and preparing of necessary items for patients with suspected high possibility of arrhythmia can be the important elements. However the ability to distinguish arrhythmias takes precedence over all of these elements, so nurses should try to learn these skills continuously because these skills cannot be acquired in short period.

As discussing this topic, the various forms of arrhythmias are as follows; atrial / Junctional / ventricular / atrial-ventricular / myocardial infarction related / associated electrolyte imbalance. All of these can vary in severity, however rather than the atrial arrhythmias, the ventricular arrhythmias is often associated with high fatalities.

In any cases of arrhythmia, the most important thing is observing the patients and following the emergency protocols and procedures. Nurses should not forget the importance of 12-lead ECG recording so that they can predict and determine the extent of the emergency. These records can be used for accurate diagnosis of the cause of the arrhythmia and offer the most important information for proper treatment.

The heart functions are important because they are the bodys primary source of delivering essential nutrients to various organs. If it does not properly supply nutrients to other organs, other organs may suffer acute or chronic dysfunction. Therefore, the skills for distinguishing various arrhythmias may be one of the most important and essential capabilities required for the intensive care nurses.

2. Conclusions

This is served as a brief introduction to arrhythmias. The nurses should remember the importance of distinguishing the various types of arrhythmias because it helps medical staffs treat the patients with the correct procedures.
Ventilator associated Pneumonia (VAP) is a common complication in patients with mechanical ventilators, and it can be defined as the pneumonia that develops in a patient with endotracheal tube and mechanical ventilation for 48 hours or more. It is a preventable secondary consequence of endotracheal intubation and mechanical ventilation. Ventilator Associated Pneumonia commonly results in an increase in length of stay (Intensive Care Unit, ICU) by 5-7 days; an increase in length of stay (hospital) by 2-3 fold; an increase of additional hospital cost of US$ 40,000 per hospital admission; and an increase of mortality by 25-50%. Patients receiving mechanical ventilation have an incidence of VAP infection of approximately 22.8%. The risk of pneumonia increases 6-20 fold in patients with endotracheal tubes and mechanical ventilators.

Two factors that are critical in pathogenesis of VAP are: colonization and pulmonary aspiration. Colonization refers to the accumulation of micro-organisms in certain parts (e.g. oral cavity) of the human body without causing any symptoms of infection; but when the colonized micro-organisms migrate to other part of the body (e.g. lungs), infection occurs. Common sites of colonization include oral pharynx, dental plaque, nasal sinuses, nasal cavity, gastro-intestinal tract, endotracheal tube and ventilator circuit. Pulmonary aspiration refers to the entry of oral cavity content or gastric content into the lungs. The oral cavity and gastric content normally contain many micro-organisms, and movement of these contents into the lungs is likely to cause lung infection.

Other than giving anti-microbial drugs to manage VAP, preventive measures should be taken early to prevent the development of such infection in ventilated patients. Commonly used measures for preventing colonization include the use of oral antiseptics, dental brushing, or the use of a silver-coated tracheal tube. Commonly used measures for preventing pulmonary aspiration include head-of-bed elevation, subglottic suction, adequate tracheal tube cuff pressure, polyurethane ultrathin tracheal tube cuff and tapered cuff tracheal tube.

There is increasing evidence in the literature to suggest that there may be links between using cuff pressure monitoring device, using different tracheal tube materials (ultrathin cuff, silver coated cuff), and choosing taper-shaped cuff on VAP reduction. Despite a number of studies done previously on tracheal tube and VAP, the effectiveness of tracheal tube on reducing or preventing of VAP is not clear. The goal of this review is to systematically review all relevant studies related to the effectiveness of tracheal cuff pressure, material and shape on VAP.
SEDATION AND ANALGESIA IN THE ICU

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Sedation and analgesia are essential components of the care of the critically ill patient, yet they remain two of the most challenging and controversial aspects. The most appropriate way of meeting patients’ sedative and analgesic needs, while also optimising their long term recovery, has been questioned. Pain remains one of the most problematic memories that many patients report after recovering from critical illness. International guidelines (1) have established standards in some aspects of care, although many aspects continue to have insufficient evidence, or require adaptation for individual patients and local contexts.

There is widespread agreement that minimisation of the sedative impact of sedation and analgesia to allow the patient to interact and participate in his or her care is likely beneficial. Despite this principle, it is often difficult to achieve due to extreme levels of pain, anxiety, fear and agitation.

Effective assessment is the first essential step in effective care and various instruments have been developed to assess both pain and agitation levels. Two pain scales, the Behavioural Pain Scale and the Critical-Care Pain Observation Tool, have been rigorously developed for use with the ICU patient and their implementation is recommended. Similarly a number of sedation assessment scales have been developed with the Richmond Agitation-Sedation Scale and the Sedation-Agitation Scale being the most appropriate for the ICU patient.

Effective strategies to optimise sedation and analgesia management remain uncertain. Limited evidence regarding effective analgesia remains although pre-emptive analgesia, for example prior to procedures likely to cause or exacerbate pain, is considered beneficial. Use of non-pharmacological strategies, for example positioning, heat and cold, explanation, relaxation techniques and involvement of the family are encouraged. Nurse directed sedation protocols showed early promise in several international settings, but have been found to offer no benefit in many settings. Daily sedation interruption also had early support, but recent evidence indicates a lack of benefit and in fact indicates an increase in aspects such as overall sedation requirements and nurse workload.

Strategies to meet the sedative and analgesic needs of critically ill patients are required. These strategies should revolve around the principle of minimising the sedative effect of medications and optimising non-pharmaceutical components of care. Adaption of strategies to local contexts and the individual needs of every patient is essential.

References
HIGH-FLOW OXYGEN THERAPY: THE CONCEPT AND CLINICAL APPLICATION

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Inadequate heating/humidification of the airways is known to result in drying of secretion, airway obstruction, and infection. Heating and humidification of respiratory gas is, however, often overlooked at the bedside. Because mucociliary function is the primary and essential defense mechanism of the respiratory system, heating and humidifying of inspired gases (at 37°C with 44 mg H2O/L absolute humidity) is mandatory during oxygen therapy. For non-invasive administration of oxygen, there have been low-flow system (nasal cannula, oxygen mask), and high-flow system (Venturi mask). Both of these two are not ideal with regard to humidification of inspired gases. Heated high-flow nasal cannula is a newer method that is believed to combine the advantages of both oxygen delivery systems. This new device has been shown to be effective in pediatric patients. Beyond the use in pediatric population, it has recently been introduced to adult patients. According to a systematic review, heated high-flow oxygen therapy in adults may be useful in optimizing oxygenation in adults with intermediate respiratory failure. Studies upto now suggest the therapy may obviate the need of intubation in some patients who would otherwise develop frank respiratory failure. It has also shown to reduce the need of re-intubation in patients with post-extubation respiratory failure. Besides optimization of the respiratory mucosa, high-flow oxygen therapy is known to reduce dead space, inspiratory work of breathing, and provide augmented airway pressures. The latter effect may translate into increased lung volume (and thus improved oxygenation) via mild PEEP-like mechanism. Most patients describe the therapy as comfortable as conventional nasal cannula. The efficacy and safety of high-flow therapy in patients with COPD is not established yet. According to a recent study, intubation in patients with impending respiratory failure may be delayed with the use of high-flow oxygen therapy, and such delay may result in poorer outcome compared with timely intubation. Further studies are needed to determine its position in the continuum of severity of hypoxia and in types of respiratory failure (hypoxic versus hypercapnic).
USING BIS MONITORING IN THE ICU - GOLDEN PERIOD FOR EXTUBATION

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Historically anesthesiologists and anesthetic technicians had no direct means of assessing the patients svjestnost during surgery and were dependent on recommended doses of drugs and indirect indicators of awareness, including changes in blood pressure and pulse. There are two possible unfavorable outcome that the patient receives too little or too much anesthetic. If the patient receives too little anesthetic there is a risk to awaken during surgery, such experiences may be traumatic for the patient, but also even more can be traumatic for the operator, and the anesthesiologist. On the other hand, if the patient receives too much anesthetic, unnecessarily increase the cost of drugs, the possible longer wakeup, postoperative complications, such as nausea and vomiting, and prolonged recovery. These factors can lead to inefficiencies in the operating room and PACU, and increase treatment costs. The American College of anesthesia technicians, the Royal College of Anaesthetists and Association of Anesthesiologists Great Britain and Ireland and the Australian and New Zealand College of Anaesthetist emphasize the importance of the monitor to monitor brain function and recommend their use in patients who are at increased risk for awareness. With the application of BIS Monitoring to prepare anaesthesiology technician placing the BIS sensor on the forehead of the patient, and testing of the BIS monitor, the anesthesiologist has a direct tool for assessing the patients awareness of the introduction of anesthesia, during anesthesia and waking from anesthesia, also monitoring may continue to be in the PACU or ICU.

Intraoperative patients are high-risk patients because of the possibilities of developing a number of complications in the postoperative period. The development of modern medical technology leading in 1994 to the implementation of BIS monitoring.

BIS monitored represents the depth of anesthesia as a result bispectralnom analysis of EEG was used to measure the direct effect of the anesthetic and a sedative in the brain. The method captures alpha-waves that occur in the state of wakefulness, or in a relaxed state.

Originally BIS monitoring was used only in the operating room, but nowadays more and more used in other medical units where necessary sedation patients (endoscopy, radiology, intensive care unit).

The use of the BIS in the intensive care unit showing numerous clinical benefits for patients: the faster awakening from anesthesia, less potential for anxiety and anxiety, reduce nausea, hemodynamic stability, shortening time spent on mechanical ventilated in the intensive care unit and lowering the cost of treatment.

We can conclude that the BIS monitor has multiple advantages over other forms of monitoring patients on exit from anesthesia.
EARLY PROGRESSIVE MOBILITY: EFFECTS ON THE BRAIN AND IMMUNE SYSTEM

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Background: Physical activity attenuates inflammation and enhances levels of brain-derived neurotrophic factor (BDNF). Attenuation of systemic inflammation is crucial for critical illness survival. In critical illness, early progressive mobility (EPM) is implemented to improve patient outcomes.

Aims: To critically review evidence on the anti-inflammatory effects of physical activity, as well as to summarize data on BDNF in critical illness and to draw implications for future research in EPM.


Results: Exercise modulates BDNF and its receptor in peripheral blood mononuclear cells. Two studies have addressed BDNF levels in critical illness, and none in relation to progressive mobility. BDNF is critically involved in the bidirectional signaling between immune and neurosensory cells and in the regulation of parasympathetic system responses. BDNF is also intricately involved in the inflammatory response: inflammation induces BDNF production, and, in turn, BDNF exerts pro- and/or anti-inflammatory effects. Nursing practice implications of these associations are discussed. Despite, the established association between physical activity and attenuation of inflammation, inflammatory markers have not been addressed in relation to mobilization activities in critically ill individuals.

Conclusion: BDNF is a potential mediator of the anti-inflammatory effects of exercise and of the cholinergic anti-inflammatory pathway during EPM in critical care. Several issues remain to be addressed in the future, including the effect of progressive mobility protocols on: a) immune and inflammatory markers in critical illness, and b) on activation of the cholinergic anti-inflammatory pathway. BDNF modulation may also be investigated as a potential marker of the appropriateness and adequacy of individualized progressive mobility protocols.
HYPOTHERMIC THERAPY POST CPCR

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Many efforts have been made in the last decades to improve outcome in patients who are resuscitated from sudden cardiac arrest. Of various conditions after successful resuscitation, hypoxic-ischemic brain injury remains the most common cause of death and morbidity. Thus investigations have focused on early neuroprotection for the prevention of hypoxic-ischemic brain injury. For this purpose, therapeutic hypothermia (TH) targeting at 32-34°C has become standard care in comatose survivors after cardiac arrest since two pivotal randomized clinical trials. To date, TH is the only strategy able to provide effective neuroprotection in clinical practice. A more recent clinical trial, however, has shown that TH targeting at 33°C did not confer a benefit as compared with a targeted temperature of 36°C. Thus, minimal degree of TH and/or avoiding fever (therapeutic temperature management) may be an alternative strategy to neuroprotection in cardiac arrest victims. If therapeutic temperature management has comparable neuroprotective effects to TH, this alternative strategy may be helpful in avoiding complications due to TH. However, further investigations on adequate target temperature are necessary. Other issues on TH in comatose survivors of cardiac arrest include timing and duration of cooling, cooling methods, rewarming methods, complications of TH, and a development place of cardiac arrest (out-of-hospital vs. in-hospital), etc. In this session, the presenter will address aforementioned issues on TH in comatose survivors after cardiac arrest.
BACK TO THE BASICS: CREATING EVIDENCE BASED NURSING PROTOCOLS TO IMPROVE PATIENT OUTCOMES

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Florence Nightingale wrote It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm. In our current work cultures, basic nursing care activities and communication strategies designed to prevent harm, are frequently seen as just tasks to be completed before the end of the shift or just one more project. This session outlines processes and communication strategies to use within your unit or organization for revaluing of fundamental nursing care practices to achieve sustainable outcomes. Working together with the participants, an action plan around one nurse sensitive outcome indicator pressure ulcers using the Interventional Patient Hygiene (IPH) model is developed.

The 2014 International Guidelines state the incidence rate for pressure ulcers in the ICU ranges from 3.3-53%. In today's cost conscious environment, this type of preventable injury can no longer be place in a low care priority position. How well do we succeed at offloading pressure in the sacral and heel area with enough frequency to prevent injury, reducing shear/friction or eliminating the impact of moisture in acute & critically ill patients? A review of evidence based strategies and care resources will be outlined to address the current barriers to achieving practice standards around skin injury. Impactful nursing care to achieve the best patient outcomes happens when the nurse is able to advocate, feels supported and reconnects with the core belief that the fundamental nursing care practices are more than just tasks but part of our advocacy role of preventing harm and improving quality care.
EXPERIENCES OF FOSTERING AN EBP CULTURE

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In today's rapidly changing environment, the implementation of EBP in practice are very difficult job to every one of healthcare personnel (BM Melnyk & E Foneout-Overholt, 2011). To implement and expand Evidence-based nursing care at bedside, individual nurses, team, and organizational change are crucial. In Korea, small group of nursing leaders and professors are getting to start Evidence-Based Practice to their clinical nursing practice and were making of the infrastructure. Publication of books for implementing of EBP (MW Park, 2006; MO Gu, 2011), establishing the EBP center (JBI center of Yeonsei university, the college of nursing). But their were no change in clinical fields.

From 2009, some leaders of major tertiary hospitals were introduced and adopted EBP process and models for their nursing care excellence. They are eager to introduce of the concept, process of EBP to the clinical areas and spreaded EBP culture to other hospitals and nursing society in Korea. In 2012, Korean society of EBN was founded and hold the conference or workshop for EBP expansion in Korea.

To do the evidence based nursing practice at bedside, individual nurses can make a clinical questions and follow the process of EBP. The other point is they are noticing to develop the evidence based practice guidelines in nursing practice.

In this paper I will share of my experiences of fostering EBP in bedside care in tertiary hospital and the role of Korean Society of EBN and Hospital Nurses Association in Korea for several years.
DEVELOPMENT OF EVIDENCE BASED NURSING GUIDELINES

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There are two type of evidence based nursing guidelines (EBNG) development; de novo, and adaptation. Adaptation method is preferred to de novo method if the resources (experts, time, budget etc) are not enough. In this lecture, followings will be introduced.

1) Adaptation process prepared by ADAPTE Collaboration (2009)

2) Examples of EBNG developed by adaptation method: pressure ulcer guideline, indwelling urinary catheterization guideline and diabetic foot care guideline
ADVANCED NURSING RESEARCH IN THE ICU

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Scientific nursing research in critical care is an important role to evaluate clinical practice and to develop new knowledge and best evidence of nursing practice. Recently, research agenda and research priorities for nursing research in critical care have been presented in the United States and in Europe. They emphasize collaboration and multidisciplinary research approach, focusing on various areas of research, understanding complexity and diversity of human research targeting patients with critical illness, and enhancement of infrastructure for critical care research. In addition, research priorities for critical care nursing present infection control, patients outcomes, development of evidence-based practice, and ethical issues. However, there are still challenges in developing research capacity in critical care even though nursing researches in critical care have been advanced. Active and clinical based strategies may be established to foster and to advance nursing research in critical care.
VALUING NURSING RESEARCH IN CRITICAL CARE

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Nursing research in critical care aims to improve the care of critically ill patients by acquiring, discussing, distributing, and promoting evidence-based information relevant to critical care nursing. The relevant topics addressed in critical care has been addressed, along with the analysis of critical research articles that have been most frequently cited in terms of content and methodologies in relevant journals. The analysis showed that nursing research in critical care is mostly related to several topics such as Developments, advancements or updates on nursing care, Treatments, or procedures, cutting-edge medical or surgical therapies, Evidence based practice, Nursing care of patients with specific critical care health problems, and Care plans, critical pathways, and patient care protocols for critical care. Mostly cited research articles in critical care are also consistent in this topic list, including tool/guideline development study, clinical study addressing nursing interventions, and multi-center prospective/cross-sectional studies. Also the trend of utilizing qualitative research design to explore patients and familys experience in intensive care units has been recognized. Based on the literature review and topic analysis, future direction of nursing research in critical care is also addressed for the trends in topics and methodologies from evidence based perspectives.
PUBLISHING STRATEGIES

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Many people who have something really important to contribute to the nursing profession fail to get their work published simply because it is presented poorly or has not adhered to the particular journal guidelines for authors. Therefore, one of the most critical aspects of preparing a journal article for submission is to ensure that it is presented in the best possible way.

This presentation will examine the importance of ensuring quality aspects of articles for submission to a peer-reviewed journal: authorship; getting the structure right: proof reading, reviewing, revising text; checking the author guidelines; ethical issues around publication (accurate data, appropriate claims, anonymity of participants, declaration of interest); issues of copyright and permissions; reference style; using critical friends; cover letter; responding to reviewers.
DEVELOPING CRITICAL CARE PROGRAMS

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With an aim to improve the health care of people in Hong Kong and to promote nursing excellence through regulating specialist nursing practice and education, the inception of the idea to establish the HK Academy of Nursing (HKAN) started in 2002. With the concerted efforts of local nursing leaders and the statutory bodies, universities, associations/colleges, public and private health care sectors and the full support from the government, we had a Preparatory Committee set up in 2008 and then The Provisional Hong Kong Academy of Nursing (PHKAN) incorporated in 2011. In line with the development of the infrastructure of the PHKAN, 14 Specialty Nursing Colleges were established. Hong Kong College of Critical Care Nursing (HKCCCN) is one of them. At present, advanced practice nurse (APN) is only a position and not yet a qualification in Hong Kong. It is expected that the Academy in future will accredit the qualification of advanced nursing practice when it becomes a statutory body.

To pave the way for critical care nurses to become members, then fellows of the Academy College, programs at different levels are required. Basically, programs are set at three levels: elementary, post registration and post graduate levels. The elementary one is for new recruits to ICU, they have to complete Elementary Critical Care Nursing programs on ECG, Respiratory Nursing, Cardiac vascular Nursing, Reno-Neuro-Trauma Nursing. They have to be Advanced Cardiac Life Support providers. With around two years ICU experience, their employers will send them to study the program entitled Post-registration Course in Intensive Care Nursing (PRCC in ICU) or equivalent. This PRCC is a 6-month course comprising 18 study days Theoretical Input and 12 weeks Clinical Practicum. The practicum should be conducted in recognized training sites with mentors. Masters Programs are offered by universities. Usually, students will be allowed to complete the program (varies from 400Hrs to 550 Hrs) as part time students over a period of 2-6 years. The programs are delivered in the form of modules/subjects and clinical project or dissertation. Contents of which are stemmed from the Advanced Practice Nurses (Critical Care) competency framework stipulated by Hong Kong Association of Critical Care Nursing and the Hong Kong College of Critical Care Nursing.

Subsequent to being a holder of Masters Degree, critical care nurses can choose to write the Advanced Practice Critical Care Nurse (APCCN) Certification Examination to become a member of the college and academy. Then choose to undergo the fellowship assessment to become a fellow of the Academy. In pursuit of excellence in specialization, this presentation attempts to map out the three levels of critical care program and the roadmap to become a member and then fellow of the Academy of Nursing in Hong Kong.
EDUCATIONAL PROGRAM FOR ICU NURSES

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Critical Care Nursing requires systematic competence that can assess and address emotional problems in critical care and communicate with medical team members effectively as well as physiologic needs. Critical Care Nurse should assess patients condition and manage equipment that patients use in critical care.

A. Education Principles

1. Education Process
   1) Assess: Education Needs, Education Objectives
   2) Education Design
   3) Teaching: Knowledge, Assessment skills, Clinical Practice, Critical Thinking skills
   4) Evaluation

2. Education Method
   1) Electronic Learning
   2) Live Instructions
   3) Preceptor-ship
   4) Simulation
   5) Clinical Self Reflection

B. Education Program in Critical Care Nursing

1. Orientation
   1) Duration: 4~12 weeks
   2) Method: Live instruction & Preceptor-ship & Simulation
   3) Evaluate Clinical Practice skills
   4) Contents:
      (1) Respiratory Assessment & Ventilation Monitoring in the Critically Ill Patient
      (2) Basic EKG recognition skills & Cardiac Drugs and Drips
      (3) Invasive Catheters, Tubes and Lines
      (4) Basics of Hemodynamic Monitoring
      (5) Renal: Abnormalities and Treatment

2. Transition

3. Competency Assessment

4. Ongoing Education
THE DEVELOPMENT OF TECHNICAL AND NON-TECHNICAL SIMULATION CONTENTS IN NURSING EDUCATION

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Clinical practice education in nursing has been rapidly blended with simulation techniques within the last decade, especially that of using high-fidelity human patient simulators. A sharp slope of the number of related nursing research represents the given trend and implies a forthcoming need of developing simulation contents within a distinctive context of nursing discipline and practice.

In this presentation, the previous nursing research on simulation education will be summarized and the knowns versus unknowns will be discussed. Given the fact that formerly developed simulation modules were unquestionably skewed on a technical part in nursing, the author will address the status-quo and the future of developing non-technical simulation contents in nursing education.

In order to coordinate non-technical part in nursing practice, the theory on the levels of caring is proposed in which the development and application of non-technical nursing simulation will be feasible. In that, the detailed concepts and scenario flows according to the theory will be presented. In addition, the methodological means for simulating non-technical contents will be discussed. Taken into account the fact that the authentic transference of caring is perceived and interpreted by nursing clients not only through technical but non-technical part in nursing, simulation education needs to take a responsibility for educating nursing students in both technical and non-technical portions of nursing with a theory-based balance.
HORIZONTAL VIOLENCE IN KOREA ICU NURSES

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Horizontal violence is defined as repetitive negative verbal, psychological and physical behaviors toward coworkers. It is also called horizontal hostility, lateral violence, workplace bullying, nurses eat their young or Tae-um in Korean. The types of horizontal violence include verbal abuse, threats, exclusion, insults, severe criticism, making fun of, taking way opportunities, teasing, disturbing, being nasty, interception of information and breaching privacy issues. In terms of nursing practice, unfair patient assignment, refusing help, and refusing to work together can be considered as horizontal violence. About 1517% of Korean ICU nurses meet the Mikkelen & Einarsons criteria of being victims of workplace bullying. According to 2 recent studies, more than 90% of the ICU nurses responded that they had experienced horizontal violence in the past 6 months shows that the severity of bullying within ICU nurses is quite significant.

Nursing work environment and organizational culture turned out to be significant influencing factors of horizontal violence in Korean ICU nurses. The degree of horizontal violence experience was higher in nurses working in poorer environments, and nurses who were strongly aware of relationship-oriented culture experienced less horizontal violence. Horizontal violence had a negative impact on the nursing organization and the safety of patients as well as on the individual nurses. Violence can lead to psychological distress, symptom experience, and intention to leave in the victim nurses. As for the structural equation modelling of horizontal violence in Korean nurses, the relationship-oriented organizational culture is a key antecedent, influencing the PsyCap (hope, self-efficacy, optimism, resilience) and intention to leave, as well. And, the horizontal violence is a mediating factor between relationship-oriented organizational culture and symptom experience (direct effect), and intention to leave (indirect effect). This model highlights the importance of nursing organizational culture to prevent horizontal violence and to improve high turnover problem in nursing.

The first step in reducing horizontal violence in the nursing workplace is to improve the nurses awareness of it through the education. Recently, several researchers proposed the cognitive rehearsal technique to teach vulnerable nurses how to handle unexpected violent situation in the workplace. Other interventions to improve relationship between nurses would help to prevent horizontal violence. The role of the head nurse is also important in the work environment of the nursing units and the interpersonal relationships between nurses. If the head nurse did not take appropriate action against negative acts in nurses, this would lead to a normalization of violence in the units, and a higher rate of turnover of nurses.
HEALTHY WORK ENVIRONMENTS FOR CRITICAL CARE NURSES

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Intensive Care Units have been shown to have the highest turnover rates and there is currently limited scientific evidence on how to retain critical care nurses.

Studies have shown that one of the most commonly listed incentives for this group of nurses is organizational support in the form of access to educational opportunities and career development. Strategies are urgently needed to stabilize the critical care nurse workforce and ensure healthy workplace environments. Findings will be presented from a Canadian study that examined how a specific professional development intervention, which included human simulation, influenced intent to stay among critical care nurses. In addition, essential elements of healthy nurse work environments will be discussed and implications for managers, education and policy.
PROFESSIONAL QOL IN THE ICU

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Professional quality of life (ProQOL) is coined by Beth Stamm. ProQOL includes the feelings and perceptions that professionals have in relation to their work. According to Stamm, a positive manifestation of ProQOL is compassion satisfaction. Negative manifestations of ProQOL is compassion fatigue which includes secondary traumatic stress and burnout.

Compassion satisfaction is feeling a sense of accomplishment and reward as a result of caring. Critical care nurses might experience compassion satisfaction as a positive outcome from working with critically ill patients.

Researches in nursing indicates that poor ProQOL, namely high compassion fatigue, negatively impacts quality of care. Many things contribute to high compassion fatigue, including workload, job setting, interpersonal relationships, leadership and education, etc.

Nursing is a profession with a high probability of experiencing a low ProQOL. Critical care nurses may be especially at risk to express high level of compassion fatigue and low compassion satisfaction because of the nature of their practice working with individuals who are experiencing life-threatening illness. A low ProQOL has a negative effect on a nurses mental and physical health and it reduces the quality of nursing care. Therefore, measures to improve the ProQOL of nurses are imperative. Nurses ProQOL was affected by ethical dilemmas, professional nursing values, nursing work environment, patient safety culture, resilience, positive coping, emotional expression, position, positive interpretation, self-blame and so on.

ProQOL relates to the recruitment and retention of health care professionals, perceived stress, silencing response, etc. Therefore, its needed that we should establish the strategy of management programs or curricula on compassion fatigue and enhancing professional satisfaction for nurses.
PALLIATIVE CARE IN THE PICU

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1: Introduction to pediatric palliative care

Pediatric health care
Late 1800s
Early to mid 1900s
History of pediatrics

Site of Pediatric Death
Institutions
Intensive care units

Palliative care

Principles of Hospice and Palliative care for children
Precepts of palliative care for children
Child and family as unit of care
Adolescents and young adults have distinctive needs
Attention to physical, psychological, social and spiritual needs
Interdisciplinary team approach
Education and support of child and family
Extends across illnesses and settings
Bereavement support

2: Childrens concept of death

Infant, toddler
Has no concept of death but can perceive sudden loss of caregivers
Reacts to separation and loss
Distressed by changes in routines, caregivers, parental emotions
Early childhood
Sees death as temporary and reversible, like the person is asleep
Fear separation, abandonment, pain
May fear contagion of terminal illness

School-age
Begins to see death as irreversible, real
May view death destructive, scary, violent
Sees death as naturalistic

Later school-age
Views death and final, irreversible
Interested in details about biologic death and funerals
May feel sad, afraid, lonely

Adolescence
Mature understanding of death
May deny own mortality through risk talking
Aware of immensity of loss
May have great difficulty coping and be unable to accept support

3: Decision making
Four predominant principles in health care ethics for decision making
Respect for autonomy: right make decisions
not harming a patient
Beneficence: helping a patient
Justice

4: Pain management
What is pain?
Pain is transmitted through the brain, spine and nerves that are responsible for sensory stimuli that cause the pain to feel the pain
An unpleasant sensory and emotional experience
Feel anxiety, fear and depression
Pains Harmful Effects
Cardiovascular and respiratory systems are significantly affected by the pathophysiology of pain
Pathophysiology of Pain
pulmonary vital capacity
alveolar ventilation
functional residual capacity
arterial hypoxemia
suppression of immune functions, predisposing trauma patients to wound infections and sepsis
Pain assessment
Position
Quality
Relieving or aggravating factor
Severity
Timing
principles of analgesic use
Types of pain for the patient, dose, route of administration selected
Select or add an analgesic according to the WHO 3 step analgesic ladder
Frequently observed effects evaluate and if the lack of pain control change the painkiller prescription

5: Spiritual distress

What is spiritual distress?
Spiritual distress a disruption in the life principle that pervades a person entire being and that integrates and transcends ones biological and psychological nature.
Spiritual assessment
Concept of God or deity
Sources of hope an strength
Important religious practice
Relationship between spiritual beliefs and health
What are the signs and symptoms of spiritual distress?
Sorrow, depression, anger, fear, guilt
Questions the meaning of life.
Afraid to fall asleep.
Anger at God/higher power

What to do?
Urge expression and accept feeling
Contact, clergy, psychiatry/psychology
Explain dying process
Talk with them to provide tie to humanity, consult psychiatry
APPLICATION OF ADVANCED DIRECTIVES

Eun-Hee Choi

Korean Bible University, Republic of Korea

Bacterial infections caused by antibiotic-resistant organisms are common health concern in pediatric intensive care units (PICUs). Hospital-acquired infection is an increasing problem in intensive care units, where the patients are more susceptible and the organisms often more resistant than in other environments. The majority of PICU patients receive antibiotics for suspected bacterial infections that were not definitively confirmed by laboratory tests. The prevalence of resistant pathogens varies between countries and units and over time in the same unit. Therefore, it is important to know local epidemiology of major pathogens frequently identified in that PICU and their patterns of antibiotic susceptibility.

Within the PICU, timely and appropriate empiric antibiotics can improve outcomes in critically ill patients with infection. The treatment of serious bacterial infections is complicated by the fact that time to initiation of effective antimicrobial therapy is a strong predictor of mortality. Therefore, therapy must be initiated before the causative pathogen is identified. However, inappropriate or inadequate initial empirical therapy is associated with increased mortality, morbidity, and length of hospital stay. Initial empirical therapy with broad-spectrum antimicrobials attempts to provide treatment active against the most likely pathogens until culture/susceptibility test results are obtained. After the causative pathogen is identified, streamlining to more-precise therapy of the shortest acceptable duration is implemented. It is also important to emphasize to discontinue the antibiotics when the clinical progression, laboratory, and culture results do not support a bacterial etiology.

In summary, start with a broad-spectrum antibiotics and modification to pathogen-specific treatment can decrease the risks of death, morbid complications, increased duration of hospital stay (as a result of ineffective initial treatment), and emergence of resistance (due to extended treatment with broad-spectrum agents).
BEREAVEMENT CARE PROGRAM FOR FAMILY MEMBERS

So-Hi Kwon
Kyungpook National University, Republic of Korea

Bereavement is one of the most difficult experiences in our life. Although grief is the normal response to bereavement, it may cause serious effects on physical and mental health, and social relationship by influencing our thoughts, emotions and actions. Health care professionals in critical care setting are often encountered to the grief of people in their care, and are called to improve the bereavement process. Each of professionals has his/her own way of caring the patients and the family during the time when care for the patient has changed from preserving life to allowing death with dignity. However, it is important to understand the nature of grief and bereavement, how we grieve in diverse cultural context, and what we can provide to patients and family during this difficult time. Therefore, this presentation will discuss a couple of cases and research findings regarding following subjects:

1. The nature of grief: Grief is the holistic, unique and subjective response to a significant loss of something or someone that is valued. In other words, no one has the ability to feel someone else’s grief. Grief impacts on the whole self, which means that grief may have physical, psychological, emotional, spiritual, cultural, and social expression.

2. Sociocultural consideration in bereavement care: Koreans view of death and mourning rituals are influenced by traditional shamanism, Buddhism, Confucianism, and recently Christianity. In Korean perspectives, we are born, growing up, getting old and sick, then die, that are a natural course of life. If someone dies in young, it is against the course of nature. The family member shared he the different responsibilities, depending on your status in the family. As an example, the first son and his wife are responsible for taking care of the parents and for making decisions at the end of life care. Guilt feelings may arise if they feel that they have not done everything to save their parents life. In a study revealed that Korean young adult children who experienced the death of a parent suffered from social stigma and prejudice against single-parent family, as Korean culture continues to consider single parent families as defective and incomplete.

3. Bereavement programs: AACN National Teaching Institute suggested the card stock photograph, handprint, angel wings, and information folder for bereaved family as an evidence-based solutions and best practice. The author reviewed literatures regarding the bereavement programs for diverse population and setting.
TOUCH AS A THERAPEUTIC MODALITY IN THE ICU

Halima S Kabara
Aminu Kano Teaching Hospital, Nigeria

Touch may be the undocumented intangible factor that leads to a patients speedy recovery

Touch is not fully understood non-verbal cues of patients seeking affirmation

Attempts were made to discover ICU staff collective interpretation of the importance of therapeutic touch in the nurse-patient relationship. Delineation was made between nurse initiated touch and therapeutic touch. Review of literature revealed a historical description of touch as it relates to the healing arts. A one-question questionnaire was distributed to all staff of ICU (Drs, Nurses, and Physiotherapists) at the Aminu Kano Teaching Hospital, Kano. Nigeria. Results were listed as ordinal data; measures of central tendency were calculated, as was a confidence interval of a point estimate, the mean of the collected ordinal data. Statistical inferences were drawn, and opinions of staff as to the value of touch were reviewed. Authors observations were listed on how touch towards patients was administered amongst ICU staff.

No literature was found on the optimal times per day a patient needs to be touched or to the time of day that touching would optimize its use in the healing process, or on the specific non-verbal expressions by the patient indicating that touch by a nurse would be therapeutic.
NURSING CARE FOR DELIRIUM PREVENTION

Soo Kyung Park
Korea University, Republic of Korea

Background & Objectives: Prevalence of delirium, defined as a syndrome characterized by an acute onset of cerebral dysfunction with a change in mental status, disorganized thinking, or an altered level of consciousness, in intensive care units has been high. Clinical practice guidelines for the management and care for patients with delirium in intensive care units are needed. Delirium mechanisms, physiologic and behavioral characteristics of delirium, risk factors, screening tool for delirium, and prevention and management of delirium will be discussed. Current evidence will also be discussed, based on findings from research studies.

Methods: Prevalence of delirium was 11-87% in intensive care units. Out of two subtypes of delirium, hyperactive and hypoactive, mixed-type and hypoactive type of delirium were prevalent in intensive care units. Risk factors for delirium include preexisting dementia, use of opioids, benzodiazepine, imbalance of electrolytes, prolonged use of physical restraints, and alterations of melatonin secretion. Confusion Assessment Method for the ICU can be used to assess delirium in intensive care unit. Early ambulation and promoting sleep should be considered for prevention of delirium.

Conclusions: A better understanding of mechanisms and factors that contribute to delirium can guide clinical practices and help health care providers develop effective intervention for this problem, and consequently improve patient outcomes.
THERAPEUTIC USE OF MUSIC IN THE ICU

Soo Ji Kim
Ewha Womans University, Republic of Korea

Recent research has enhanced our understanding of how the body responds cognitively, psychologically, and physiologically to music. Based on the growing evidence supporting the positive impact of music on the human condition, the use of music in intensive care unit (ICU) as a non-pharmacologic treatment modality has sparked a great deal of interest. However, there is a lack of consistency in the application of music therapy interventions. From simple music listening to active music making, music applications are found in a range of research articles, including RCT studies (Chlan et al., 2013; Beaulieu-Boire, et al., 2013) and reviews (Bradt, Dileo & Grocke, 2010; Philips, 2007). A number of techniques, including music for distraction, active music involvement, and music entrainment, have been developed in music therapy to address patients biopsychosocial needs. Besides music listening which has been extensively researched, the role of music and music interventions will be reviewed. Much more research remains to be done to clarify the effects of music in ICU, yet the discussion should be done to allow for the development of protocols for evidence-based music intervention.
ICU RESEARCH WITH FAMILIES

Marion Mitchell

Griffith Health Institute, Griffith University & Princess Alexandra Hospital, Australia

Background: An admission of a relative to intensive care is stressful for families. To help them support the patient, families need assurance, information and an ability to be near their sick relative. Flexible visiting enables patient access but how this impacts on patients, families and staff is not universally understood.

Methods: A descriptive mixed-method before/after design was used. Participants came from a general ICU in a tertiary-care hospital in Australia. ICU patients were interviewed; family members completed the validated Family-Satisfaction in ICU survey and described their perceptions of flexible visiting. ICU staff completed a survey and/or participated in focus groups.

Results: Interviewed patients (n=12) were very positive about extended visiting hours. Family members’ (n=41 [pre]; n = 140 [post]) overall satisfaction with care remained high, and 87% of families in the post period (n=117) were ‘very satisfied’ being able to be with their relative beyond the previous visiting hours. Twenty-four percent of visits occurred outside ‘usual visiting hours’. Families stated that flexible visiting facilitated important communication with staff. Three-quarters of the staff were satisfied with flexible visiting and thought the identified barriers could be readily overcome by role modelling family inclusion and continued use of the developed clinical guidelines.

Conclusion: Patients, families and ICU staff positively evaluated extended visiting hours in this ICU. Families took advantage of the increased hours and valued the additional opportunities. Junior staff may benefit from peer-support and guidelines to promote a family-centered approach.

Keywords: Family-centred care; visiting; communication; staff satisfaction
DIFFICULT DECISION MAKING

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Parents of babies in the NICU are faced with a particularly difficult set of circumstances with regard to decision making for their child. As the survival rates for very preterm infants are increasing, health-care providers and parents are confronted with the ethical dilemma to continue or withdraw care of critically ill neonates. These issues may challenge the assumptions, values and beliefs of all those involved in the care of very immature infants. Parents need to fulfil their role as parents and that role encompasses difficult decisions about the care of their infant. Parental involvement should be part of the decision making to begin treatment, its ongoing impact and recognition of its ineffectiveness when that occurs. Parents therefore require detailed information to facilitate informed decision making. Information is essential to help parents understand the reality in which they find themselves. Parents need the time to think, to assimilate and process information and consider their decisions in the light of their own values and beliefs. The decision to withdraw life support is very painful, leaving parents with feelings of loss, emptiness, guilt, anger, and pain. Establishing good relationships and clear communication between health-care providers and parents builds trust and eases stress placed on parents making decisions about the care of their infant. Available approaches to care need to address ethical decisions regarding treatment, pain and suffering, quality of life and decisions to move from active to palliative care. Neonatal palliative care includes bereavement support for the family after the infant's death but begins with care for the living infant. Palliative care and end-of-life programs improve parental support throughout the entire course of their infants care and facilitate parents decision making. Support from the NICU staff is important as parents face many challenges during the difficult time of facing withdrawal of life support decisions.
FAMILY CENTERED CARE IN THE ICU

Adriano Friganovic, Vedran Dumbovic, Irena Vugrek

University Hospital Zagreb, Croatia

OBJECTIVES: Effective interdisciplinary meeting with the family of a critically ill patient has come to represent a standard of quality care in the intensive care unit. Critical care nurse communication training has largely been limited to didactic materials, interactive training for nurse supervisors, or brief participatory learning programs within the context of comprehensive end-of-life care educational seminars.

AIM: The aim of this paper was to make systematic literature review to find relevant data about family centered care in intensive care units.

METHODS: The Medline database was searched to identify relevant studies and articles published during the last 10 year period. Keywords that were used for this paper were related to family centered care, nursing and intensive care unit.

RESULTS: During the search we have found 31 scientific papers and according to exclusion criteria for this paper we used 10 articles. The available literature showed that family centered care is basic for providing quality nursing care and to reach patient satisfaction.

CONCLUSION: Nursing care focused on the family of the patient is an important factor in the overall satisfaction of patients as our service users. Patient satisfaction greatly improves treatment outcome and reduces the number of days in the hospital.

Keywords: Family centered care, intensive care unit, Nursing
HOSPITAL WIDE REDUCTION IN NOSOCOMIAL INFECTION - A PRACTICAL APPROACH

Gerald Williams
World Federation of Critical Care Nurses, Australia

Nosocomial infections are one of the more common preventable deaths in the hospital setting. Yet hand hygiene practices and aseptic techniques remain below acceptable standards.

This presentation demonstrates how one hospital has exceeded national benchmarks for hand hygiene and nosocomial infections by putting in place a structured program that enforced compliance with evidence-based practice and good clinical hygiene. The strategies included: reduced signage and clutter; hand hygiene safety scrum; hand hygiene audits, auditing training and reporting as well as specific strategies in the ICU setting to improve aseptic techniques and vigilance.

Hand hygiene audits showed compliance across this health service went from 70% to 90% and nosocomial infection rates more than halved and were sustained there after.

This presentation demonstrates that alignment of clinical practice and management direction with evidence-based practice can prevent unnecessary and deadly infections in the hospital setting.

Practical tips and tools are available to assist participants in applying these techniques easily in their own setting.
PRESSURE INJURY RISK ASSESSMENT

Paul Fulbrook

Midwifery & Paramedicine, Australian Catholic University, Brisbane, Australia

Pressure injury risk assessment is a crucial aspect in determining the relative risk of patients and the need for preventative intervention. In the intensive care setting there are few risk assessment scales that have been developed specifically for use with critically ill patients. The aim of this study was to test the psychometric properties of the COMHON Index - a new pressure injury risk assessment tool designed specifically to assess intensive care patients. Three other scales were tested: Braden, Norton and Waterlow. A convenience sample of 26 intensive care patients was used. Five intensive care nurses scored each patient with all four scales. Intraclass correlation coefficients and standard errors of measurement were used to assess interrater reliability and agreement of the sum, risk category, and item scores. Pearson product moment correlation coefficients were used to investigate the association between the sum scores of the scales and similar constructs within the scales. The interrater reliability of the COMHON Index was higher than the other scales and strong correlations were found between it and the Braden and Norton scales but not the Waterlow score. Two items common to all four scales (mobility and neurological status) demonstrated significant correlations between the COMHON, Braden, and Norton scales but not the Waterlow score. One item (nutrition) was significantly correlated between the COMHON and Braden scales. In conclusion, the interrater reliability and agreement of the COMHON Index were the highest of the four scales, with the Norton and Braden performing similarly, and the Waterlow score the least well. The strong and significant associations between the Braden, COMHON and Norton scales suggest they are measuring similar constructs.
AIR PRECAUTION IN THE ICU

Hye Ran Choi
University of Ulsan, Republic of Korea

Intensive care units (ICU) have small percentage of all of hospital beds. However the prevalence of health-care-associated infections (HAIs) has been reported to greater in ICU patients than in general wards and HAI caused worse prognosis and/or complications. There are many factors to cause HAIs, including extreme age, advanced age, variable invasive procedure, immunocompromised status, implantation of foreign bodies, transplantation, and increase of patients with underlying diseases.

Patients admitted to ICU are surrounded with a lot of kinds of microorganisms, that could be at risk for infection or carriage. The risk of HAIs is related to the mode of transmission of the infectious agent; contact, droplet, and airborne transmission. Contact and droplet precautions are well performed because of many cases that are needed both precautions such as multi-drug resistant organisms or droplet-producing procedure. However, there exist inappropriate circumstances of airborne precaution due to lack of information/data or shortage of protective equipment, isolation rooms, or facilities.

There is need of more attention to the airborne infection in comparison with contact and droplet infection because airborne infection causes more exposure to patients/care-givers and healthcare personnel. It is recommended that routine monitoring and surveillance of infection, compliance of infection prevention procedure (hand hygiene, etc.), patient placement, personal protective equipment, cleaning, disinfection, and sterilization of environment and equipment, inspection of ICU structure such as ventilation system or negative-air-pressure room, and so on.
ICN PATIENTS’ RIGHTS: CRITICAL CARE CONSIDERATIONS

Gordon Speed
Dunedin Public Hospital, Southern District Health Board, New Zealand

Intensive or Critical Care patients are generally the sickest in the hospital, are having invasive and complex treatments, and are at high risk of complications and death. This can be emotional and stressful to both the carers and the families involved. These situations that can arise to ethical issues include end of life care, consent and competence, limitations to therapy, privacy, use of controversial drug treatments, what to say on the phone, use of information technology and involvement of legal authorities.

I will discuss some basic ethical principles from a nurses point of view and illustrate the problems with some examples. Hopefully this will give you some ways to think about the challenging situations in your workplace. I will try to show an international perspective and consider how the examples may be treated in different counties.

Ethics is nothing else than reverence for life Albert Schweitzer.
MORAL DISTRESS IN THE ICU

Shelley Schmollgruber

University of the Witwatersrand, South Africa

Nurses are intimately involved in End of Life (EOL) care and their experience is intensified by their intimate and sometimes intense interactions with both patient and family members. End of life care has a propensity to engender moral distress (Lutzen, Dahlqvist, Eriksson et al, 2006; Hamric, Davis & Childress, 2006; Gastmans, 2012). Emotional, social, physical and professional consequences are likely (Elpern, Covert & Kleinpell, 2005; Corley, Minick, Elswick et al 2005; Gutierrez, 2005, Nathaniel, 2006).

South Africas health system is complex displaying diverse disease patterns: acute and infectious diseases, high maternal and child mortality, non-communicable diseases and violence and injuries often exacerbated by patients HIV status (McNeilly, 2011).

Problem and purpose

Causes of and responses to moral distress of nurses caring for critically ill and dying patients have not been sufficiently explored in the South African intensive care arena. The purpose of this study was to elicit the nurses perspective of the clinical situations in the ICU evoking moral distress; the consequences and means they employed to manage their distress.

Process and findings

A short survey/interview guide, derived from Corley, Elswick, Gorman and Clors extensively used and validated Moral Distress Scale (Corley et al, 2001), requiring narrative descriptions and explanations was distributed to registered nurses (N=100, n=100) in trauma, general medical and surgical and cardio-thoracic ICUs in tertiary, academic hospitals in Johannesburg. Data were triangulated by augmenting the information recorded from focus group discussions. Experiences of the situations, many engendered by perceived morality of the treatment and decisions made, as well as participants reactions and subsequent actions are described.

REFERENCES


Keywords: Moral distress, end of life care, critical care nurse
NURSES’ ATTITUDE FOR DEATH AND DYING PATIENTS

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In the critical care setting, nurses are often facing on death and dying patients. On the boarder of life and death, nurses should play a critical role to provide good care. For providing quality of care in the critical care setting, nurses attitudes toward death and dying may impact on their care. The purpose of this study was to describe nurses attitudes toward death and dying in the critical care setting and explore factors influencing their attitudes and outcomes.

As a method, an integrative review of literature was applied with the published research findings regarding nurses attitudes toward death and dying. Over the 5 years, among 66 retrieved articles in PubMed and CINAHL database, 25 articles were used to analyze with five steps: problem identification, literature search, data evaluation, data analysis, and data presentation.

Nurses attitudes toward death and dying could impact on nursing care at the end of life situation in the critical care setting across the world. Specifically, nurses preparedness related to nurses attitudes may lead to quality of death and dying. Well-structured education could affect nurses attitudes toward and enhance nurses competency.

In conclusion, critical care nurses should be analyzed their own attitudes toward death and dying and prepared the care at the end of life. Especially end of life nursing education may have influence on nurses better care and appropriate attitudes toward death and dying in the critical care setting.
CRITICAL CARE NURSING IN AUSTRALIA

Marion Mitchell
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Critical Care nursing has been a specialty in Australia since the 1960s. There are approximately 10,000 critical care nurses in Australia and around 140 critical care units. Critical care nursing has evolved into a highly specialised area that functions collaboratively with medical and allied health colleagues. This presentation explores critical care nursing in Australia from four perspectives. Firstly, formal post graduate education will be highlighted as the expectation for Australian critical care nurses who are also required for their yearly registration to demonstrate professional development and competency in their speciality. Secondly, clinical practice speciality units will be outlined and include paediatric units. One-on-one patient care provides the general nursing model around Australia with limited incorporation of non-registered nurses. Thirdly, the strength of Australian critical care nursing research will be explored. Finally, the functions of the Australian College of Critical Care Nurses will be explained in regards to the representation and support it provides to critical care nurses, health care agencies and government bodies.

Keywords: Critical Care nursing; education; clinical practice; research; professional organisation; Australia
CRITICAL CARE NURSING IN KOREA

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The quality of patient care at Intensive care unit should meet its expectation of them. as such, it is safe to say that critical care nursing system of any country has become standardized.

It is my opinion that such system of Korea does not have any unique difference, but regardless, I would like to inform you on the status and nursing care system of ICU in Korea.

In comparison to the structure or system of ICU of those countries where I visited, no significant difference was found in medical equipments, monitors and supplies in use. It is also Korean hospitals top priority to ensure the safety of patients.

With a focus on such matter, decisions on system operation and patient treatment are being made.

As medical complexion of patients have diversified, ICU has operated in specifically classified units such as internal medicine, surgical, cardiovascular, neurological, pediatric, cancer, etc.,

Currently, Korean Association of Critical Care Nurses is making efforts to improve the rating of ICU nursing staff. In the past, annual survey showed that all participated hospitals had various ratings from grade 1 through 7, however it has recently improved as nursing labor ratio per bed has increased.

In addition, a recent survey showed that used period and type of medical equipments have been diversified, which proves that recent trends for patient care have been applied to current treatment and care system.

And since a number of hospitals in Korea which prepare for and receive the JCI international accreditation is increasing, the nursing contents of Korean ICU are expected to meet the international standards.

Intensive care is also taken in place for patients who need various medical equipments such as Ventilator, ECMO, Nova-lung and CRRT and who receive organ transplants for all kinds of organs(i.e. heart, lung, pancreas, kidney etc.)

Furthermore, we have a quality management for improving the quality of care indicators and through this, the importance of ICU nursing is being highlighted.

I believe that this was an opportunity to introduce the system of ICU in Korea.

In the future, nursing care of ICU must find a way to fully utilize environmental, human, and physical resources and to establish policies to improve its status within hospitals.
SUPPORT FOR THE NIGERIAN CRITICAL CARE NURSING: THE WFCCN CONNECTION

Halima S Kabara
Aminu Kano Teaching Hospital, Nigeria

Collaboration with World Federations and Societies is key.

Effort is under way to develop a Multi-disciplinary Critical Care workforce for Nigeria, in Pediatrics and Adult Intensive Care Units.

The National Association of Nurse Intensivists of Nigeria (NANIN) is Collaborating with other health care organizations and relevant agencies to develop the guidelines for professional practice.

Focused on upgrading of critical care training in Nigerian universities and maintenance of high standard of critical care services.

The results of a recent WFCCN international survey on the most important issues facing critical care nursing across 65 countries showed Priority areas that were identified included staffing levels, working conditions, access to quality educational programs, wages, formal practice guidelines/competencies and team work. Other factors of importance to the survey respondents were extended/advanced practice, relationship with physicians, formal credentialing process, and use of technologies. With the WFCCN Connection, Nigerian Critical Care Nurses are going places, and the Standard of Care has improved tremendously in most ICUs.

The philosophy of the WFCCN is to assist critical care nursing associations and nurses regardless of age, gender, nation, colour, religious beliefs or social background in the pursuit of the objectives of the WFCCN.

The purpose of the WFCCN is to link critical care nursing associations and nurses throughout the world, to strengthen the influence and contribution of critical care nurses to health care globally and to be a collective voice and advocate for critical care nurses and patients at an International level.

Historically, critical care nursing organization (CCNO) leaders from around the world have established forums at various international critical care congresses.

One of the objectives of WFCCN is to represent critical care nurses and critical care nursing at an International level.
COMMUNICATION IMPROVEMENT PROGRAM

Seong Suk Kwak
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Promoting communication activities between nurses, nurses and doctors are related to patient safety and good quality of health care activities.

It also makes increase in the quality of nurse’s job satisfaction and in same time we should expect declining in resignation rate.

Promoting communication activities are encourages making cooperative culture between every health care provider, and it is related to bring better result of patient treatment.

Inaccurate information delivery between health care provider, and if it hasn’t delivered properly in the right time, it could be threatening to patient safety.

Sixty percent of sentinel events in health care provider’s communication failure. Therefore, health care providers must have accurate and rapidly exchange patient information, sharing plans with other occupations and therapeutic targets expressed freely and communicate effectively.

In reality, however, especially ICU nurse turnover during the shift and night shift work loads, if the professional role conflicts and high job stress gradually progress to unhealthy physical and mental depression, fatigue, exhaustion, illness etc. occurs resignation, resulting in a deterioration of nursing quality, therefore it requires for promotion of communication.

In particular, new nurses are lack of knowledge, lack of experience, lack of competence, faced with excessive stress and pressure, fear, difficulty with relationships.

Therefore, new nurses are encouraged to be well settled by the celebrations and activities support, career nurses makes the sympathy and encouragement to cheer up a variety of events. Various healing programs and safety, Provide preceptor workshops and participate in various educational opportunities.

The interdisciplinary intensive care(doctors, nurses, pharmacists, dieticians) share the results and treatment plan of the patient through the rounds and have a chance of growing more actively communicate the roles of nurses for patient safety, and the team satisfaction increases.

Each intensive care unit actually communicates and solves problems through the proposed regular meetings with the physicians and becomes well done.

The nurse who respects themselves and respect between nurses furthermore, other occupations employees, patients, and caregivers to respect and promote the communication without misunderstandings or antipathy to each other is promoting patient safety.

In fact, Seoul National University Hospital intensive care unit will therefore continue to consistently improve communication activities.
PURPOSEFUL ROUNDING IN THE ICU: ENHANCING COMMUNICATION

Gordon Speed
Dunedin Public Hospital, Southern District Health Board, New Zealand

I will discuss the use of rounds in the Intensive or Critical Care Unit and how this is used to enhance communication. I will discuss various types of rounds, including purposeful rounding with consideration of how to enhance communication, and consider international differences with care and staffing models. My main example will be how rounds are used in the ICU I work in but I shall compare this to other international models.
A STRATEGY TO ENHANCE THE TRANSITIONAL CARE FOR COMMUNICATION FROM THE ICU

Heesung Park

Samsung Medical Center, Republic of Korea

Purpose: To meet the needs of critically ill patient, seeking to explore the process involving family members when being transferred from an ICU to general ward which increases overall anxiety.

Method: We focused on organizational changes to improve efficiency of the ICU discharge process. so we developed transitional care project, it is provided by professional critical care nurses, called Relief nurse. There were 10 Relief nurses in three ICUs specializing in medical, surgical, thoracic surgical fields.

Results: We determined criteria for classification to the need of transitional care before transfer; premature discharge, continuum care process, patient and family complaints and grievances. The intervention categories secure, encourage, and education are strategies used for the ICU transitional care. Total implementation of transitional care were 420, Continuum care process 84.8% (356), premature discharge - 11.4% (47.9 ), patient and family complaints and grievances 3.8% (16) during 1 year.

Conclusion: ICU transitional care is three-way communication between staff and patient/family, between team members and involved units, and between patient/family and environment. Relief nurses to provide security, encouraging support, and education maintain ICU discharge process in safe.
ICU STAFFING TO MATCH PATIENT CARE NEEDS

Adriano Friganovic, Vedran Dumbovic, Irena Vugrek
University Hospital Zagreb, Croatia

OBJECTIVES: Management of daily activities in ICUs is challenging. ICU shift leaders, charge nurses and intensivists have to make several immediate ad hoc decisions to enable the fluent flow of ICU activities. Even though the management of ICU activities is quite well delineated by international consensus guidelines, we know only a little about the content of the real clinical decision making of ICU shift leaders.

AIM: The aim of this paper was to make systematic literature review to find relevant data about ICU staffing to match a patient need.

METHODS: The Medline database was searched to identify relevant studies and articles published during last 10 year period. Keywords that were used for this paper was related to family centered care, nursing and intensive care unit.

RESULTS: During the search we have found 18 scientific paper and according to exclusion criteria for this paper we used 7 articles. The available literature showed that ICU staffing is a first step in assuring quality nursing care and to reach patient care needs.

CONCLUSION: Nurse staffing is one of several variables influencing patient safety. These findings further suggest the need to study the impact of nurse-staffing levels on in-hospital mortality using nursing-unit-level specific data.

Keywords: ICU staffing, patient need, nursing
CONFLICT MANAGEMENT IN THE ICU

Vedran Dumbovic
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The ingredients of conflict are

Needs - Needs are things that are essential to our well-being. Conflicts arise when we ignore others needs, our own needs or the groups needs. Be careful not to confuse needs with desires (things we would like, but are not essential).

Perceptions - People interpret reality differently. They perceive differences in the severity, causes and consequences of problems. Misperceptions or differing perceptions may come from: self-perceptions, others perceptions, differing perceptions of situations and perceptions of threat.

Power - How people define and use power is an important influence on the number and types of conflicts that occur. This also influences how conflict is managed. Conflicts can arise when people try to make others change their actions or to gain an unfair advantage.

Values - Values are beliefs or principles we consider to be very important. Serious conflicts arise when people hold incompatible values or when values are not clear. Conflicts also arise when one party refuses to accept the fact that the other party holds something as a value rather than a preference.

Feelings and emotions - Many people let their feelings and emotions become a major influence over how they deal with conflict. Conflicts can also occur because people ignore their own or others feelings and emotions. Other conflicts occur when feelings and emotions differ over a particular issue.

Conflict is not always negative. In fact, it can be healthy when effectively managed. Healthy conflict can lead to growth and innovation, new ways of thinking and an additional management options. If the conflict is understood, it can be effectively managed by reaching a consensus that meets both the individuals and societys needs. This results in mutual benefits and strengthens the relationship. The goal is for all to win by having at least some of their needs met.

Intensive care units (ICU) are inherently stressful units. Indeed, patients severity and uncertainty in prognoses are responsible for symptoms of anxiety and depression in family members. Family grief, excessive workload and the complexity of every decision-making process lead to fatigue and burnout in nurses and doctors.

There are five steps to managing conflict.

These steps are:
- Analyze the conflict
- Determine management strategy
- Pre-negotiation
- Negotiation
- Post-negotiation

What skills do you need to manage personal conflict?
Understanding your own feelings about conflict. This means recognizing your triggers, words or actions that immediately provoke an emotional response, like anger. It could be facial expression, a tone of voice, a pointing finger, a certain phrase. Once you know your triggers, you can better control your emotions.

Active listening. Go beyond hearing just words; try to understand what the other person is saying. Listen carefully, instead of thinking about what you’re going to say next. Active listening requires concentration and body language that says you are paying attention.

Generating options for resolving a conflict. Many people can think of only two ways to manage conflict—fighting or avoiding the problem. Get the facts straight, brainstorm all ideas that might help resolve the argument, and discuss the pros, cons, and consequences.

Even though conflicts might threaten the quality of care and have serious repercussions on daily ambiance, only a few studies report on the incidence, determinants and implications of ICU conflicts. Nurses, physicians, patients or family members can detect conflicts. They can be measured during an interview or by a questionnaire survey, and either during an ICU stay or after a patient’s discharge. We will have a questionnaire survey what Croatian nurses think about head nursing, managing conflicts and resolving a staff conflicts at hospitals.

Prevention of conflicts remains a major challenge. However, as a first step, a descriptive study on the typology of conflicts in a large number of ICUs will help identify clinical implications of conflicts, and also possible targets for interventions aimed at reducing ICU-conflicts.
ROLE OF EMPLOYEE SAFETY MANAGER

Youngsun Jung
Asan Medical Center, Republic of Korea

Role of Employee Safety Manager
At Asan Medical Center, we have a systematic management system that aims to prevent and to rapidly counteract the occurrence of safety threatening acts toward patients, visitors and employees.

ESM Operative Goal: to reduce violent and safety threatening acts and to take the appropriate measures against violent acts that have already occurred.

ESM Duty Patterns: Composed of two employees and a two shift system. 8:00AM ~ 10:30PM (Group A: 8:00 ~ 16:30 ,Group B:14:00 ~ 22:30) AMC Police is composed of two personnel per group with a total of six people working a three shift schedule.

ESMs Main Roles:
1) Reporting to the site of safety threatening situation
   : AMC police and ESM contacted through the hotline are to be dispatched to the site in need of emergency response (assault and personal contact, verbal abuse, rowdiness and disturbance, damage to property etc.)
   : continuous management of nonemergency situations (uncooperative of medical practice, complaint among patients)

2) Patrol Management (Periodical Rounding)
   : two periodical rounding per duty and frequent patrol. (Patrol Area: 2 times per day for vulnerable places, once per day for general wards, and once every three days for hospital surroundings and external parameters)
   : consultation of patients that have a possibility of displaying safety threatening acts during patrol.

2014 ESM Activity Results
1) The number of emergency situations where the ESM was dispatched was 107 cases. (verbal abuse: 26, disturbance: 61, assault: 4).
   The number of nonemergency situations was 4,757 cases (remarkable patients: 4,362, standby: 282)

2) The number of emergency situations where AMC police was dispatched was 1,970 cases.(verbal abuse: 120, disturbance: 446, assault: 16).
   The number of nonemergency situations was 1,388 cases. (medical assistance: 892, patient transportation: 294, standby: 188).

3) The number of emergency response situations are continually decreasing due to efforts in creating an environment where employees whom are constantly exposed to dangerous situations can work safely, and also in the continuous management of problematic patients.
ENHANCING QUALITY AND SAFETY OF ICU CARE

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Critical care units must manage the intersecting challenges of maintaining a high-tech environment and ensuring staff competency in operating the equipment, providing high-quality care to the facility's sickest patients, and tending to the needs of staff members working in a very stressful environment. Every day there are many patients who are harmed or even die because of medical errors. Half of these incidents are preventable. Patient safety is a vast field of knowledge aiming to prevent errors and harm to the patients. Both healthcare organizations and the individual physicians have a responsibility in patient safety and healthcare quality.

Patient safety applies two analytic methods.
1. Root cause analysis (RCA) is a method of problem solving used for identifying the root causes of faults or problems.
2. Failure mode and effects analysis (FMEA) involves reviewing as many components, assemblies, and subsystems as possible to identify failure modes, and their causes and effects.

Several important factors play a role in fostering patient safety in the ICU environment.
1. Having a culture that supports and promotes safety activities.
2. Operating an ICU structure in which the care of ICU patients is directed and managed by intensivists—physicians with specialized training in critical care medicine.
3. Ensuring that the work environment can support the ability of caregivers to interact productively, make vital decisions, and perform medical interventions and operate medical equipment safely.
4. Rapid response teams manage critical situations with the goal of preventing avoidable deaths.
5. Adequate risk assessment tools may help nurses considerably in enhancing patient safety.
   - CAM-ICU, RASS, CNPS, NRS, Braden scale
6. Checklists have been acknowledged to be valuable instruments to increase patient safety.

Patient Safety goal:
1. Improve the accuracy of patient identification.
2. Improve the effectiveness of communication among caregivers.
3. Improve the safety of using medications.
4. Reduce the harm associated with clinical alarm systems.
5. Reduce the risk of healthcare-associated infections.
6. Conduct a preprocedure verification process.

Strong team-work and effective communication between nurses, physicians, and personnel from other disciplines have been associated with improved outcomes such as decreased lengths of stay and reduced mortality rates. However, health care providers occasionally do not recognize that effective communication is crucial to create teams that foster safe environments. Reviews of critical incidents indicate that poor communication is a major contributing factor. Therefore, successful teamwork requires strategic communication to address and meet common goals for patient care. Health care providers are just beginning to prioritize communication and team-work as essential elements for success.

Patient safety requires that all members of the health care service delivery team be patient-safety minded. As a quintessentially collaborative activity, patient safety needs leaders in each area of clinical administration and in each clinical discipline—including doctors, nurses, pharmacists, and others—in addition to information management, equipment and plant management, and other areas.
Patient safety is a critical component of quality health care. The notion of upholding the standard of patient safety should be implemented in the entire continuum of health care. An individual's incompetence or negligence may contribute to errors threatening patient safety. However, as indicated by international research evidences, most harm caused to patients is likely attributed to problems of the health care system. According to the World Health Organization (WHO), patient safety improvements demand a system-wide effort including performance improvement, environmental safety, and risk management. To develop solutions which are evidence-based and expert-based to inform both health care providers and health care systems on addressing common safety problems may become one of the key strategies.

The International Patient Safety Goals (IPSG) aims to promote specific improvements in patient safety, and to highlight the most common problems in health care as well as to provide support with simple and effective system-wide solutions. According to Joint Commission International (JCI), all accredited health care systems have been required to implement the IPSG since January 2011 under the International Standards for Hospitals. The six goals of IPSG are: Identify Patient Correctly, Improve Effective Communication, Improve the Safety of High-Alert Medications, Ensure Correct-Site, Correct-Procedural, Correct-Patient Surgery, Reduce the Risk of Health Care-Associated Infections, and Reduce the Risk of Patient Harm Resulting from Falls. Each goal contains three components including standard, intent, and measurable elements. The standard refers the principle of that goal, the intent explains the rationale of the standard, and the measurable elements represent the detailed requirements from the standard and intent that are scored.

Patient safety in intensive care units is even more important as patients there are suffering from life-threatening illnesses and the critical care setting is one of the most complex environments in a hospital. Patient safety is fundamental to nursing care, and nurses are dedicated to identify issues and implement safety measures to benefit patients and their health care systems. For nurses working in critical care settings, they will have to manage all tasks and challenges simultaneously while remaining focused on delivering safe patient care following the approaches suggested by IPSG.
UNPLANNED EXTUBATION OF ICU PATIENTS WITH MECHANICAL VENTILATION

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Maintaining endotracheal intubation is the first priority in mechanically ventilated patients for lifesaving & patients safety. However, occurrence rate of unplanned extubation reported rates range from 3.4~22.5% in ICU & unplanned extubation in ICU is still considered life-threatening issues. The definition of unplanned extubation is self-removal of the endotracheal tube by action off the patient or accidentally removal during any procedures.

For patients safety in ICU, risk factors and patients outcomes related to unplanned extubation be identified & improved. Keeping endotracheal tube safely involves patient safety measure such as the maintaining of appropriate sedation (Atkins et al., 1997), and manage delirious patients (hofso & cover, 2007).

Risk factors of unplanned extubation includes patients physiologic factors such as respiratory problems, severity of illness, vital signs, consciousness level and psychological factors (Chevron et al., 1998). Work system factors related to unplanned extubation are reported including technology & tools, organization, tasks & environments. Moreover, risk factors of unplanned extubation are also reported physical restraints, type of intubation, fixation method of endotracheal tube, mechanical ventilation mode, nurses staffing, night time, type of ICU, admission route of ICU & others. Pain, agitation & delirium of ICU patients are identified significant predictive factors of unplanned extubation (2013, Kwon).

Patient outcomes of unplanned extubation delayed ventilator weaning of patients, prolongs length of stay in ICU & hospital & increasing mortality rate. Reintubation rate are between1.8% to 88% after unplanned extubation. Serious complications associated with reintubation as a result of unplanned extubation are aspiration pneumonia, fetal arrhythmia, cardiac arrest & death.

The occurrence rate of unplanned extubation can be reduced by through preventative protocol. Intervention includes the management of patients pain level, sedation and mechanical ventilator weaning (Jarachovic, Mason, Kerber & McNett, 2011).

In conclusion, caring of patients with endotracheal intubation in ICU must contain risk factors of unplanned extubation for attaining patients desired outcome.
MAINTAINING SKIN INTEGRITY IN CRITICALLY ILL PATIENT

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Critically ill patients who are cared in intensive care units (ICUs), are a unique population who should be paid attention to maintain skin integrity. Critically ill patients could be the highest group of develop pressure ulcer, skin injuries such as skin tearing by friction, edema, medical adhesives. Pressure ulcer rates in the critical care population, are reported as the highest among hospitalized individuals because of the comorbidity; hemodynamic instability, poor tissue perfusion and oxygenation requiring the use of inotropics, anticoagulants and confrontation with multiple, concomitant risk factors repeatedly.

Additionally, old patients with fecal incontinence who are in ICUs are vulnerable population to cause incontinence associated dermatitis (IAD) that is related to develop pressure ulcer. They need structured skin care protocol consisting of skin cleaning and moisturization to prevent pressure ulcer. And also,

Especially medical device related pressure ulcers (MDRPU) are more developed intensive care units due to using many different types of devices to monitor patients hemodynamic status, oxygenation, and ventilation than other units. Nurses should be aware of edema under device(s) and potential for skin breakdown and confirm that devices are not placed directly under an individual. Medical Adhesive Related Skin Injury (MARSI) is a emerging new issue in skin care problems, but it is commonly observed in all level of care setting regardless of age. The prevalence and incidence of MDRPU, MARSI and IAD has not been published, and under-reported in South Korea. It is important to do research about those of things for patients safety and develop evidence- based best practice to prevent skin injuries.
KEEPING CRITICALLY ILL PATIENTS SAFE DURING INTRAHOSPITAL TRANSPORT

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Transporting a critically ill patient within the hospital creates a work environment that is both challenging and highly stressful, even for experienced providers. Critically ill patients are often cared for in unusual environments such as hallways, elevators, and procedure areas not typically designed for critical care monitoring or interventions.

Intrahospital transport of intensive care unit patients is a particular challenge, because of the severity of the illnesses and the need for continuous therapies during transport, particularly mechanical ventilation. This has led to the development of specific monitoring and ventilatory equipment that is designed to manage this situation. This type of intrahospital transport is associated with a high incidence of complications, which mostly relate to patient conditions or equipment problems.

Adverse effects may affect a variety of organ systems, may be related to the movement of the patient or may be caused by equipment malfunctions. Furthermore, the reduced availability of personal, equipment and monitoring away from the intensive care unit may be detrimental. These adverse effects may be of short-term or long-term duration, or require interventions.

To prevent adverse effects of intrahospital transports, guidelines concerning the organization of transports, the personnel, equipment and monitoring should be followed. In particular, the presence of a critical care physician during transport, proper equipment to monitor vital functions and to treat such disturbances immediately, and close control of the patient ventilation appear to be of major importance. It appears useful to use specifically constructed carts including standard intensive care unit ventilators in a selected group of patients. To further reduce the rate of inadvertent mishaps resulting from transports, alternative diagnostic modalities or techniques and performing surgical procedures in the intensive care unit should be considered.

[Preventive Measures]
- Efficiency of transport: transport indication and risk-benefit analysis
- Stabilisation and preparation of critically ill patients before transport
- Anticipation, organization and planning of transport
- Competence of transport teams
- Adapted transport equipment
- Standardization of practices: specific protocols for managing transport
- Check lists: systematic and final check points

Overcoming the risks of intrahospital transports involves taking corrective action for all the causes, and applying methods that have been proven to work in other sectors of activity. A more widespread use of check lists and proper training plans for teams are also expected to lead to an increase in intrahospital transport safety and a lowering of risk in the long-term.
To adjust the new environment called intensive care unit, critical patients need proper analgesics and anesthetics to get rid of pain, anxiety, delirium, and other forms of suffering of being critical patients. Each therapist uses different analgesics and anesthetics and misuse of the medications can aggravate the clinical course.

As pain can trigger stress reactions such as tachycardia, increase of oxygen consumption at myocardium, hypercoagulation, immunosuppression, continuous catabolism and so forth. Critical patients complain the pain aroused by their own disease invasive medical procedure or their injuries. The main cause of the pain can come from monitoring equipment and treatment equipment and also from routine nursing process.

(1) Pain assessment
To assess the pain, one should consider the characteristics of pain, cause of aggravation or relaxation factors, degree of pain, etc.

(2) Selection of analgesics
To relieve pain in ICU, narcotic analgesics, nonsteroidal antiinflammatory analgesic drug, acetaminophen, etc can be used. For proper selection of analgesic, we should consider the pharmacologic characteristics and the side effect.

(3) Target level of Sedation
Proper target level of sedation should differ according to the process of the disease and the treatment. Generally in the ICU, the target level of sedation is the state they can be awaken easily keeping the sleep-wake cycle.

(4) Sedation level assessment
Ideal method of sedation level assessment should be convenient to calculate and to record, should clearly separate the level of sedation, should be possible to adjust the amount of sedatives according to the level of assessed sedation, should be effective and reliable to the critical patients.
PATIENT & FAMILY EXPERIENCE: EDUCATION IN THE ICU

Dongoak Kim

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PATIENT & FAMILY EXPERIENCE: SATISFACTION IN THE ICU

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WHO launched a patient safety Programme in October 2004 in response to World Health Assembly Resolution WHA55.18 to coordinate, facilitate and accelerate patient safety improvements around the world. Several actions have been undertaken to improve the safety of health care for patients in all WHO Member States (WHO, 2014). However, the issue on patient safety remains to be a big concern amongst the developing countries. According to the WHO, patient safety practices should result in measurable fiscal impact, save lives and decrease morbidity.

Provision of patient safety has always been the intent of health care providers, however, globally there are occasions wherein non-deliberate and accidental injury and harm happens to the patient. These unfavorable incidents are associated with systems that failed in relation to clinical or administrative management provided for the patient. Despite adherence to patient safety goals, adverse events still occur even in the most advanced healthcare facilities. These are preventable errors related to prescribing to administration of medication, reporting or communicating clinical information or breaks and gaps in the performance of systems and protocols of care. The most pronounced reason for these preventable errors to occur can be related to the fact that patient safety concepts are not clear to those making decisions, research has not been done in many resource-poor settings to confirm data collected elsewhere, and many authorities still have the misconception that introducing patient safety practices is a luxury (WHO, 2014).

In this presentation, patient safety concepts will be discussed by demonstrating models of core concepts in patient safety, human factors, and structure design safety concepts among others. Best practices will be highlighted that portrays initiatives to promote patient safety in ICU particularly in a developing country like the Philippines.
PATIENT & FAMILY EXPERIENCE: ISOLATION IN THE ICU
(ICU DIARY)

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Intensive care unit (ICU) survivors often suffer from psychological complications after receiving care from ICU. To improve the quality of patients life after ICU care, we provided the ICU diary for ventilated patients.

Thoracic surgery ICU had implemented the ICU diary to patients on mechanical ventilation. Diaries were written by both their families and the staffs to help them understand their ICU stay and to share their concerns and feelings. Diary was simply designed to create the therapeutic relationship between the medical staff and their families. The staff narrates daily events and shares the plan so that the patient and their families could understand the condition of the patient.

ICU diary helps patients to understand what has happened to them and fill the gaps of memory when they were unconscious or sedated. Family members enabled to connect with the patient by writing diaries about their presence and expressing their love and affection. It had provided an opportunity of humanizing experiences in ICU.

Through the ICU diary, family members not only became aware of their role as a member of caring group but also understood medical information and the patients condition better. Patients and relatives were able to receive patient-family centered treatment with the diaries.
MANAGEMENT OF STRESS IN THE ICU

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Clinical interest in mindfulness has been increasing in the psychological Nursing. Mindfulness is conceptualized as a state of mind in which ones focus is on the present moment, that is a receptive attention to and awareness of internal and external experiences as they occur. Mindfulness can be contrasted with mind state in which ones attention and awareness are preoccupied by stressful events, such as those in the past, or future.

Mindfulness came from Eastern spiritual tradition, and its recent popularity in Western psychology fields has come about because of the development of mindfulness based psychotherapy programs, such as Mindfulness Based Cognitive Therapy (MBCT), Mindfulness based Stress Reduction (MBSR), and their application to clinical Nursing. Mindfulness, Mindfulness skill training, or Mindfulness practices can enhance ones mental health state in ways that range from reducing diverse clinical symptoms to increasing psychological well-being. Mindfulness is both a skill that can be enhanced via mindfulness meditation and a psychological disposition that manifests as a tendency to be Mindful in the present moment.

The factors of reperceiving, self-regulation, self-management, emotional, cognitive, and behavioral flexibility, values clarification, and exposure to painful experiences have been found to contribute to the positive change or transformation caused by mindfulness-based interventions.

Identifying other mechanisms in the association between mindfulness and emotional well-being may have important implications for targeting alternative factors in mindfulness-based interventions. Recently, the Buddhist concept of non-attachment (Sanskrit: viraga), which is similar to reperceiving has been found to be positively associated with mindfulness and psychological well-being. Researchers have conceptualized non-attachment as a lack of fixation, nonreactivity, quicker recovery from emotional distress.

Nonattachment also has the quality of not feeling an inner pressure to avoid or cling to other person, like anxious attachment or avoidant attachment.
REFRESH PROGRAM FOR NURSES

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Workplace is where people gather to achieve common goals. There are leaders, members, and tasks to reach the goals and to improve values. Systems of organization are just tools to help leaders and members perform effectively.

Even thought you make the great vision and core values, it is nothing if the members don't be motivated. Especially, Intensive care unit nurses has a lot of many stresses. So it is a role for a leader of ICU to support ICU nurses to be happy without stress. Therefore, I'm introduce the refresh programs in Asan Medical Center in Korea.

1. Activate communication meeting
   - Staff meetings: Nurse, Nurse aid
   - Council of medical departments and Noodle Day with Doctors
   - Thanks Dinner: relevant departments
2. Refreshing activity program for career
   - New Nurse social adaptation program
   - Mentor-mentee meeting day
   - 6 months Empowerment Program
   - Independent ceremony day for 1 year career nurse
   - 4 years empowerment program
   - Once/month nurse themed trip
   - More than 10 years nurse free travel
3. Long-term vacation
4. ICU newsletter published: life shared space employee (per month)
5. Praise
   - Best Doctors selection and award
   - Friendly Staff Picks Award
   - Commended the Board trees to install and free to praise
6. Thanks to the delivery EVENT relevant departments
7. Cultural campaign to change the language attitude
8. Healing programs (management of stress)
9. Yeokjisaji (The changed role for other departments works) program
10. Birthday, Anniversary Pre-off offers
11. Relax shop operations
12. Nurse clothing laundry service
13. Vitamin D day

GWP (Great Work Place) means the conversion of a management paradigm treating workers like customers.

It also means the management of belief to use trust relationship as the most cherish tool. The effort makes our members avoid selfish perspectives and have owner spirit with the high ethics and the core values.

In conclusion, we believe that it is very natural to support them to be loving and warm-hearted GWP members.
NURSING IN THE ARTS

Jina Oh
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The arts can capture the richness of the human spirit, and provide insights to deepen understandings of complex and ethereal aspects of experience such as loss, despair, and death. Especially, some famous paintings provide means through which illness and disease may be exemplified powerfully and conveyed more meaningfully than by the written nursing text.

Celebrated pictures require one to reflect deeply on the artists perspective. Therefore, they help professional nurses improve their observation and communication skills, narrative sequencing abilities, and empathy. Celebrated paintings can be used to increase awareness of the complex nature of human beings and their conditions, and to frame clinical image and diagnoses in a humane way. Therefore, many nurse educators emphasize the need for liberal education, including the arts and humanities, as a foundation for professional nursing practice.

Frida Kahlo's works such as My Birth, The Broken Column, The Wounded Deer, and Henry Ford Hospital reflect her pain, surgery, hospitalization, and trauma. They serve to reinforce the need to recognize the variety of perspectives and to elicit the patients perspective in the provision of care.

Edvard Munch's works convey the depth of human anguish. The most notable of his works, The Scream, catches a human cry of despair at the point of greatest intensity. In another painting, The Sickroom, several figures surround a dying person. The expressions capture a sense of dread, regret, and relief as one of their own departs.

Nurses in intensive care unit face situations every day that are emotionally, ethically and cognitively complex. Viewing paintings is valuable in helping nurses to relate to their patients on human, rather than clinical, terms. Visual arts can help nurses to be better prepared to practice their profession, and can facilitate transformative and empowering experiences in their practice.
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Pediatrics Session (WFPICCS)
SCENARIO IN KOREA

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Pediatric critical care is one of the essential fields of medicine in any society. The disease status of pediatric patients who need critical care medicine cannot be managed well in the neonatal or adult intensive care unit. However, although pediatric critical care is highly important, compared with other areas of medicine, this area is not sufficiently developed in South Korea. For example, the number of medical personnel dedicated to pediatric critical care and the attendant facilities, including beds for pediatric intensive care, are far below the numbers that are needed. Perhaps this insufficiency is the result of this area being a somewhat new medical specialty. More likely, however, the main cause of this underdevelopment is the low reimbursement for pediatric intensive care within the Korean National Medical Insurance System. Korean pediatric intensivists need to become pioneers and advocates for the development of pediatric intensive care medicine in Korea.
SCENARIO IN CHINA

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In the past five years, pediatric critical care got rapid development. In December 2010, starting at the health clinical key specialty first batch of national projects, pediatrics critical care medicine (PCCM) was listed as only pediatric subspecialty in the funding subject. This was a landmark event in the PCCM development history in China. By now, totally 21 PICUs have obtained the national financial support. Nowadays, more than 50 PICUs nationwide have been established with well-equipped, providing multidisciplinary definitive care for a wide range of complex, progressive, rapidly changing, medical, surgical, and traumatic disorders, occurring in pediatric patients of all ages. Under the government financial support, the hardware of PICUs have achieved significant improvement, purchasing various medical equipment such as ventilators, monitors, hemodialysis machines. Second aspect of the development of PCCM is launch of various monitoring technology, such as hemodynamic monitoring, blood purification technology and extracorporeal membrane oxygenation, etc. So far, there are 36 PICUs have carried out CRRT procedures and 5 PICUs provide ECMO treatment for very critical patients. Pediatric Advanced Life Support courses could be supplied by the 7 PICUs professional faculty in China. Stable long-distance transfers capability achieved much higher with in local regions. Young professionals with great potential for development will be trained in developed countries for learning to expand their horizon and improve the hand-on ability by following medical training programs for pediatric intensivists. From the 2003 to 2014, the success of the treatment of children infectious diseases, epidemics of SARS, H1N1, HFMD, H7N9 in China pushed the treatment level and nursing skills to improve significantly. Established in April 2015 by the Chinese Medical Doctor Association, Paediatric Intensive Physician Branch, the academic organization will be responsible for fully implementing specialist qualification standards, formed guidelines on the basis of evidence-based medicine, release and update recommendations, implement to the daily medical practice, in order to get real benefits to critical patients.
SCENARIO IN INDIA

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Pediatric critical care is relatively young specialization, but it has taken great strides in the past two decades in India. The first pediatric intensive care units (PICUs) were established in the early 90s and many more came up subsequently, predominantly in the private sector and some in public sector. These PICUs have raised the bar in providing high quality care for critically ill children in large cities. The availability of complex and expensive medical interventions in many of the PICUs in India and the global collaboration and guidelines has expanded the discipline considerably. However, the prosperity and progress are not uniform across the country and still less than optimum. A recent survey of ISCCM ResearchNet from 48 Pediatric ICUs (21 PICUs, 2 PICU-NICUs, and 25 ICUs catering for both adults and children) all over India showed a distinct distribution of structural and organizational resources. The average bed capacity remained 16 per unit though 31% of them had less than 10 bedded units. Step-down/middle care facilities were available only in 33% PICUs. These units admitted a median (IQR) of 318 (123-406) children per year and nearly 40% of them were mechanically ventilated. A typical unit is manned by 2 doctors and 6 nurses per shift with the average nurse patient ratio of 0.8. Most of the units (92%) had 24 hour physician availability and many of them (79%) were MD graduates with variable amount of training in pediatric intensive care. However, the lack of comprehensive team was evident as the services of pharmacists, respiratory therapists and medical social workers were available in only less than 50% of the units. Mechanical ventilators (96%), monitors, defibrillators and X-ray facilities (> 80%) were widely available while the access to advanced equipments and life support technologies [bronchoscope (42%), Hemodialysis (55%), CRRT (17%), ICP monitors (16%), HFOV (4%) ECMO ( 4%)] were glaringly limited. Resources and materials aside, quality pediatric intensive care requires specialized training. The intensive care chapter of Indian academy of pediatrics (1998) and the pediatric section of the Indian Society of Critical Care Medicine (2000) function with the goal to train residents in acute care pediatrics and across India and set the standards in pediatric intensive care. A range of training programmes (Diploma in Basic Pediatric Intensive Care 1 year, Fellowship of National Board 2 years, and postdoctoral DM in pediatric critical care 3 years) are being available in 24 accredited centres across India. Opportunities are now available for clinical research in PICU and multi-centre studies across national boundaries are being supported by these professional bodies. However, research capacities still lags behind as only a fifth of the hospitals/institutions are involved in clinical research and a mere 12-15% of the units have published research papers in the last 5 years in national or international journals. In future we aim to strengthen the PICU bed capacity, indigenous production and availability of advanced care and monitoring equipments and promote continuous ongoing clinical research.
**SCENARIO IN JAPAN**

**Satoshi Nakagawa**  
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Pediatric Intensive Care Units (PICUs) and the system of Pediatric Critical Care (PCC) are not well established in Japan. Australia and New Zealand Intensive Care (ANZIC) Registry shows that they have 1.5 ICU patients per 1,000 pediatric populations. If this number is applied to my country, 27,000 pediatric patients are estimated to need intensive care annually in Japan. Currently, there are 30 PICUs in Japan, which care 9,000 patients annually. This means that two thirds of the estimated critically ill infants and children are cared somewhere else. Mechanical ventilation in children is carried out in General (Adult) ICUs as well as general pediatric wards in Japan.

Some of the ICUs in Japan are designed to serve for post-operative care and may not accept critically ill emergency patients. Critically ill infant and children from the emergency department are often not cared in the ICUs and sent to the general wards. Japanese PICU Network started to gather the data from each unit and evaluate our services in quality and efficiency. Some PICUs, usually larger PICUs, evaluate their outcome using Pediatric Index of Mortality 2 and shows good standardized mortality ratio. Based on the finding, we are working with the Ministry of Health, Labor and Welfare to establish regionalization/centralization of pediatric intensive care system in order to deliver appropriate medical services to infants and children.
DIFFICULT WEANING FROM MECHANICAL VENTILATION IN CHILDREN

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Invasive mechanical ventilation is a life-saving procedure largely used in critically ill children, aimed at maintaining adequate alveolar ventilation and effective gas exchange.

However, this essential treatment may be associated with significant complications, including lung or airway injuries, unplanned extubations, adverse hemodynamic effects, analgosedative dependency and severe infectious complications, such as ventilator-associated pneumonia.

In general, complications are often time-dependent, with a longer duration of intubation resulting in higher risk of adverse effects. Thus, limiting the duration of mechanical ventilation is crucial for the intensivist, who should aim for an early appreciation of readiness for spontaneous breathing trials and a short process of discontinuing mechanical support. However, premature extubation may also be problematic and result in emergent reintubation, with potentially catastrophic consequences. Of note, a high mortality rate has been documented in pediatric patients requiring reintubation after extubation failure. Thus, although prompt weaning and extubation are the goal, extubating too early can be detrimental.

Unfortunately, there is scarce information on how to perform an effective weaning process in children undergoing mechanical ventilation. Thus, in most cases the weaning course is still based upon the individual judgment of the attending clinician, which is usually based on assessments of respiratory efforts and respiratory drive, muscle performance and respiratory load.

Recent studies suggest the use of weaning protocols could reduce the weaning time and duration of mechanical ventilation. Standardized daily evaluation of weaning readiness, as well as daily interruption of sedative drugs, have been shown to decrease duration of invasive ventilation. However, well-defined criteria for assessing readiness to wean have not been validated in the pediatric population as yet. Similarly, elective support with non-invasive ventilation may decrease the risk of extubation failure, but the role of noninvasive ventilation in weaning protocols for children needs to be further elucidated.

In some ventilated patients spontaneous breathing trials may repeatedly fail, with need of prolonged and complex weaning phases. In these difficult to wean cases, underlying causes of weaning failure must be sought, especially during spontaneous breathing tests, by clinical examination, blood gases, echocardiography and imaging techniques. In particular, any potentially reversible pathology should be identified, while any cardiovascular dysfunction, fluid overload, respiratory muscle weakness or underlying infection should be excluded. Interestingly, new modalities of ventilatory support, such as NAVA (Neurally Adjusted Ventilatory Assist), which allows an optimal synchronization of ventilation to spontaneous breathing efforts of the patient, also in non invasive modes, seem to be valuable in patients difficult to wean from mechanical ventilation.

In conclusion, the inherent risks of mechanical ventilation can be reduced by weaning and extubation as soon as patients are able to support their spontaneous breathing. Management of pediatric patients difficult to wean requires a dedicated and experienced staff, a systematic strategy as well as an individualized approach. Although standardized protocols and computerised decision-making tools seem to be promising, further research to identify the best practices is still required. The aim is to shorten the duration of mechanical ventilation while limiting the risk of extubation failure in critically ill children.
AUGMENTING MECHANICAL VENTILATION IN CHILDREN

Nai Shun Tsoi

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Mechanical ventilation is now an indispensable tool in care of patients with severe respiratory failure. Except for very special conditions, it is not necessary to keep patient heavily sedated and paralysed as they are not without complications. Heavy sedation have shown to increase sputum retention, more ventilation perfusion mismatch, more diaphragmatic muscle dysfunction and more lung damage, resulting in more prolonged ventilator support. Minimising ventilator related complications by allowing better synchronization and augmenting patients respiratory effect is now an important strategy in ventilated patient. This challenge is even more in children as patient cooperation is more difficult. Most ventilators are designed for adult and are not suitable children with smaller tidal volume and faster respiratory rate.

For ideal ventilation, there should be minimum air leak around the non-cuffed endotracheal tube. Trigger should be sensitive to detect every spontaneous respiration with minimum false triggering. Patients effort should be supported by a mode that will not cause muscle fatigue and disuse. Termination of inspiratory cycle should be according to patients need on each breath, and adequate time for complete expiration to avoid air trapping. Pressure support is the most commonly used mode for supporting spontaneous respiration. Newer modes are now available to adjust ventilator support according to patients demand. These include proportional assist ventilation (PAV), adaptive support ventilation (ASV) and Neurally Adjusted Ventilatory Assist (NAVA). In addition, new generation of ventilators provide smart weaning program allowing automatic switch from a fully controlled ventilation to an entirely support mode.

NAVA ventilation is a new approach to synchronise and support ventilation. Through a series of sensors mounted on the wall of the nasogastric tube, diaphragmatic electrical signals can be detected and analysed, providing a faster and more reliable trigger. By monitoring the Edi signal throughout the inspiratory cycle, the support pressure can be adjusted according to patient need on breath to breath variation. With these new ventilation modes, we can decrease ventilator related complications through better augmentation of spontaneous respiration of the patient.
HIGH FREQUENCY VENTILATION: WHEN DO I USE IT?

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High-frequency oscillation (HFO) is theoretically an ideal mode of mechanical ventilation in terms of lung injury prevention, as this mode uses tidal volumes smaller than anatomical dead space and lung volumes are maintained by the adequate level of airway pressure. This mode has been common in neonatal medicine. This mode has been applied in pediatric and adult patients over the last 20 years. Recent large randomized trials in adult patients have shown no superiority of HFO over conventional mechanical ventilation. However, this result should be cautiously applied in pediatric populations.

Theoretical advantages of HFO are as follows;
1. Small tidal volumes to prevent ventilator-induced lung injury
2. Lung volume recruitment by appropriate level of mean airway pressure

In order to maintain tidal volumes smaller than anatomical dead space, it would be better to use higher frequencies. We usually start HFO at 12 hertz in infants and 8 to 10 hertz in children. Recruitability of the lung volumes varies in each patient. Some patients needs higher mean airway pressure to achieve adequate lung volumes, however, in the others lung volume recruitment may not be achieved by airway pressure titration. This means that one-size-fit-all paradigm does not work well in setting mean airway pressure of HFO and individualization of airway management should be strongly employed in HFO. When I use HFO in pediatric populations, different strategies are employed based on the lung physiology.
RESCUE THERAPIES FOR INTRACTABLE HYPOXEMIA: DO THESE MAKE A DIFFERENCE?

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Acute Respiratory Failure (ARF) is an important cause of mortality and morbidity in the pediatric intensive care unit. Non-ventilatory efforts to improve outcomes have included surfactant therapy, inhaled nitric oxide, prone positioning, and corticosteroid administration. Extracorporeal Membrane Oxygenation (ECMO) has been used to “rescue” children from ARF when they have “failed” traditional and/or alternative ventilatory therapies. Although the use of ECMO has grown over the past several decades, there still exists great variability in its use regarding patient selection, timing of initiation, method of cannulation, as well as duration of treatment. ECMO-associated complications remain significant and include both acute (bleeding, thrombosis, infections, and equipment failure) as well as long-term (need for hospital readmission, neurodevelopment, overall quality of life, and cost). There is growing evidence regarding mortality prediction in ECMO including the effect of underlying disease processes and other definable risk factors such as initiation of ECMO beyond two weeks after onset of respiratory failure.
Since the first open heart surgery for an atrial septal defect in 1953, outcomes of congenital cardiac surgery have improved greatly. In spite of increasing complexity and number of surgeries in low birth weight infants, the overall mortality is currently at less than 3%.

Diagnostic modalities

Prenatal echocardiography became established, which enables earlier preoperative diagnosis and safer perinatal care for newborns with complex congenital anomalies. Advances in imaging technology such as multi-detector CT, MRI, and intraoperative transesophageal echocardiography with a small probe help more definite preoperative planning and completeness of the operation.

Surgical strategies and techniques

Early total correction has taken priority over palliative approach in various diseases during the past decades. No surgeons consider Mustard or Senning procedure in a neonate with uncomplicated transposition of the great arteries any longer. This strategy depends on not only the progress of surgical skill but also the development of new bypass devices and techniques. Miniaturized heparin-bonded circuit and oxygenators with newly developed material for membrane minimizes priming volume, the dose of heparin and maximizes safe period of cardiopulmonary bypass time. In addition, ultrafiltration during/after the bypass can reduce its systemic inflammatory response significantly. Antegrade selective cerebral perfusion can extend the safe operation time for aortic arch procedures and minimize postoperative neurologic injury and adverse neurodevelopmental outcomes. It is not surprising to perform an endoscopic or robotic surgery in selected patients.

Perioperative care

Nowadays, pulmonary hypertensive crisis is uncommon in the ICU postoperatively. Besides the advent of early primary repair and the advance of bypass technique, we have several options of good pulmonary vaso-dilators such as iNO, prostacyclin, phosphodiesterase inhibitors, and endothelin receptor antagonists. Noninvasive monitoring of cerebral oxygenation identifies cerebral hypoxia perioperatively. Although the absolute value is unreliable, it is useful for trend monitoring.

Single ventricle

There have been some modifications for Fontan procedure. Despite a marked improvement in outcomes for the Norwood procedure, the mortality remains high, ranging from 10% to 25% with interstage mortality contributing an additional 10 to 15%. RV-to-PA shunt showed superior results to modified BT shunt in a multi-center, randomized study. Some centers prefer hybrid approach to avoid extensive surgery and long bypass time in high risk neonates.
Mechanical assist devices and transplantation

Although many centers are now providing pediatric cardiac transplantation program, the shortage of donor is still a major obstacle. Short term mechanical support with ECMO or centrifugal VAD has been established. Long-term support with a ventricular assist device (VAD) shows promising outcome in recent studies even in children. Over the last several years, there have been innovative strides in implantable VAD in adults. Implantable devices for small children are now under investigation.

Summary

Pediatric cardiac surgery continues to evolve. Improved mortality itself is no longer an acceptable goal. There is now the trend of the expectation of perfection and a zero tolerance for complications. Large efforts are being made to improve its long-term outcome, which will continue to rely on the collaborative work with other subspecialties including anesthesia, cardiology, critical care, neonatology, and neurology.
CARDIAC ARRHYTHMIA IN THE PICU

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According to the International Society of Cardiology Task Force, an arrhythmia is defined as any cardiac rhythm other than the normal sinus rhythm. Such a rhythm may be either of sinus or ectopic origin, and either regular or irregular. An arrhythmia may be due to a disturbance in impulse formation or conduction, or both. In the pediatric intensive care setting, arrhythmias are most frequently encountered in patients with congenital heart disease, particularly in the postoperative period. However, cardiac rhythm disturbances may be observed in other critically ill children with non-cardiac diagnoses. In fact, disturbances in cardiac rhythm are frequently seen on continuous electrocardiographic monitoring not only after cardiac surgery, but also as a causal effect of various pathological conditions resulting in hypoxemia, hypercapnia, dyselectrolytemia, acid-base abnormalities, and multi-organ system failure, all problems frequently encountered in the pediatric intensive care unit.

Both tachyarrhythmias and bradyarrhythmias may be caused by systemic diseases or iatrogenic treatments and procedures, or may be related to intrinsic electrophysiologic abnormalities, mostly of congenital nature.

In general, mechanisms of arrhythmias can be classified as either re-entrant, such as macro-reentrant atrial tachycardia, e.g. atrial flutter, or focal, such as automatic or micro-reentrant tachycardia, e.g. junctional ectopic tachycardia. Reentrant mechanisms account for more than 80% of clinical arrhythmias, generally involving unidirectional block and an area of slow conduction. In this case, being blocked in one direction, the electrical impulse does progress through alternative routes, and due to slowing is able to reenter the tissue from the opposite direction.

In the non-reentrant forms, arrhythmias are focal and may be due either to increased automaticity or triggered activity.

The etiology of arrhythmias in the intensive care setting is quite variable, including congenital or genetic causes affecting the specialized cardiac conduction system, as well as iatrogenic causes, such as those observed in the postoperative cardiac patients. In the latter case, most common rhythm disturbances are tachyarrhythmias, consisting in ventricular and supraventricular tachycardia, atrial flutter and fibrillation, or junctional ectopic tachycardia. The etiology is often multi-factorial, including post-procedural, mechanical or systemic injuries, as well as metabolic or infectious conditions. Risk factors for postoperative arrhythmias include lower age and body weight, longer cardiopulmonary bypass time, aortic cross-clamp time, use of deep hypothermia and circulatory arrest.

Symptomatic bradyarrhythmias are more rarely observed in the PICU and may be related to different causes, not necessarily involving the cardiac conduction system, such as hypoxia, drug overdose, severe infections and neurological diseases.

In any case, it is important to have a systematic approach to the diagnosis and treatment of dysrhythmias, which includes knowledge of the possible mechanisms and all available treatments.

This is particularly true in critically ill children, in whom the intensivist should be able to promptly recognise and interpret arrhythmias, in order to establish a correct diagnosis and provide an urgent intervention, if required. Indeed, in hemodynamically unstable conditions, immediate measures should be taken to support the patient. Current treatments options include the use of drugs, temporary pacing, interventional procedure, defibrillation or electric cardioversion.
MYOCARDIAL FAILURE IN TROPICAL INFECTIONS

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Tropical and subtropical regions are host to several unique infections because of favorable climatic seasons and geography. Dengue, malaria, scrub typhus, leptospirosis, typhoid fever, and bacterial sepsis are commonly seen in this part of the world that often present with one or more organ failures. Myocardial dysfunction either subclinical or manifesting as circulatory failure is no longer an under-recognized entity in children with sepsis and tropical diseases presenting with severe sepsis are no exception. While some infections such as typhoid fever and diphtheria are long known to affect myocardium, many other emerging diseases like dengue and scrub typhus are increasingly recognized with atypical presentations and cardiac involvement. In a cohort of 173 children presenting with tropical fevers to PICU, 40 had shock requiring vasoactive drugs. Myocardial dysfunction (LVEF < 45%) could be identified in 17% (n=7) of them (Scrub typhus -4, Dengue – 2, Sepsis – 1). Cardiac involvement in dengue has received much attention recently. A significant proportion of children with severe dengue are identified with functional myocardial impairment and acute reversible myocarditis. Both systolic and diastolic dysfunctions are observed in them. A correlation between myocardial dysfunction and clinical severity of dengue infection is also reported. In a study of 91 children with dengue, LVEF < 50% was observed in 6.7%, 13.8%, and 36% of patients with DF, DHF, and DSS, respectively. The limited available evidence suggest that at least in patients with shock unresponsive to fluid resuscitation, the possibility of concurrent myocarditis should be considered and looked for with echocardiographic evaluation. Scrub typhus is another important multi-system disease that has recently emerged as the most common tropical fevers in many Indian ICUs. Myocarditis with cardiogenic shock has been reported to occur in up to 34% of children presenting to tertiary care centres with scrub typhus. Cases of fatal fulminant myocarditis were also seen and mortality rate was higher in whom the diagnosis was delayed until patients developed hypotension. Diphtheria in tropics is known to present with a high incidence of myocarditis (66%) that too early in the course of the illness (before 2nd week). Conduction abnormalities and cardiogenic shock were the commonest manifestations and were associated with the highest mortality (78%, OR 33.3). Similarly, typhoid fever in children may involve cardiac conduction system and is well known to present with heart block. The main difficulty in describing the manifestations and frequency of cardiac involvement in these diseases is the lack of clear criteria to define myocardial dysfunction. Clinical features suggestive of myocarditis are lacking in sensitivity and specificity while ECG abnormalities, elevated enzymes and echocardiographic evidence of dysfunctions are not identified in every case. Even if concurrent cardiac involvement is identified, in many it would be difficult to determine the degree to which myocardial dysfunction contributes to shock and clinical manifestations. In clinically significant cases too, most forms of treatment currently are purely supportive, but with better understanding of the pathophysiology of tropical diseases, targeted treatment may become possible.
HEART-LUNG INTERACTION IN PICU

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The linkage between the cardiovascular and pulmonary systems occurs on a number of different levels including humoral, neurologic, and mechanical and leads to fine tuning of cardiac output on the metabolic demands of the body. In general, the circulatory effects of the normally functioning respiratory system are small. However, drastic changes in respiratory function can cause substantial changes in lung volume, pulmonary vascular resistance, and intrathoracic pressure. All of these can have profound effects on normal and abnormal circulatory function. The physiologic changes caused by altered respiration can either disturb or enhance circulatory function. There are also numerous circulatory adjustments engendered by abnormal arterial blood gas tensions associated with respiratory failure. In the field of pediatric critical and intensive care, respiratory physiology is somewhat different from that of adults according to the developmental stage and / or accompanying diseases. Especially, congenital heart diseases with hemodynamic instability are more common in pediatric intensive care. Mechanical ventilation can have important effects on circulation. The magnitude of these effects may be accentuated by factors that compromise cardiovascular adaptability, such as hypovolemia, cardiac dysfunction, or disordered vascular tone. Mechanical ventilation can alter right ventricular preload and ejection, pulmonary vascular resistance, left ventricular preload, and left ventricular afterload. These interactions may occur simultaneously and yet not act in the same direction on cardiac output. The net effect on cardiac output depends on which interaction predominates over the course of the respiratory cycle. In patients who are hypovolemic, effects of positive airway pressure on right ventricular preload generally predominate, whereas in patients who have myocardial dysfunction, effects on left ventricular afterload may predominate. Changes in arterial pulse pressure over the respiratory cycle help to predict which patients will increase cardia output with fluid resuscitation. Changes in arterial pulse pressure over the respiratory cycle on PEEP compared to changes in pulse pressure over the respiratory cycle at zero PEEP may identify those patients whose cardiac output has been adversely affected by PEEP. Cyanotic congenital heart defects such as tetralogy of Fallot, ductal dependent pulmonary blood flow lesions which need sufficient pulmonary flow to maintain oxygen supply on metabolic demand are easily affected by the respiratory changes. Ductal dependent systemic flow lesions such as hypoplastic left heart syndrome, critical aortic stenosis, and interruption of the aortic arch show profound changes of cardiac output affected by respiratory changes. Also congenital heart defects with single ventricle physiology or pulmonary hypertension may be seen in PICU and need to understand complex hemodynamic and their cardiopulmonary interactions. Respiratory efforts impose critical loads on the heart and respiratory muscle failure from inadequate circulation is a final common pathway to death in shock and circulatory impairment. Understanding of cardiac anatomy and function is the first and essential step to the management of pediatric critical care based on cardiopulmonary interaction in various conditions.
FLUID AND VASOACTIVE AGENTS: CURRENT CHOICE AND REASON

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Severe sepsis and septic shock is a major cause of morbidity and mortality in PICU. Its management is complex and time critical. Early recognition and rapid aggressive resuscitation is a cornerstone of the management and protocol-driven early goal-directed therapy (EGDT) have been shown to reduce the morbidity and mortality. EGDT is aimed at timely optimization of the macrocirculation in terms of optimizing intravascular fluid status, systemic vascular resistance, and myocardial contractility. It includes initial fluid resuscitation, early initiation of inotropes and/or vasopressors, advanced hemodynamic monitoring, and further fluid and/or vasoactive-inotropic support based on the underlying causes of hemodynamic compromise.

However, recent multicenter randomized controlled trials showed that EGDT was not associated with a survival benefit in comparison with usual care in adult patients with septic shock. Furthermore, multiple clinical studies suggest an association between positive fluid balance and increased mortality in adult and pediatric septic shock. With endothelial injury and leaky capillaries, large volume fluid resuscitation could result in tissue edema, which further impairs capillary blood flow and oxygen diffusion. For avoiding excessive fluid overload, early use and appropriate titration of vasoactive-inotropic support should be considered.

Therefore, early adequate fluid resuscitation, late conservative fluid management, and early appropriate use of vasoactive agent on an individual basis may be necessary for further improvements in outcome of children with septic shock.

The choice of resuscitation fluid is a topic of debate (crystalloid vs colloid, isotonic saline vs balanced salt solution). There could be theoretical advantage in using colloids for resuscitation in septic shock and albumin replacement showed a potential outcome benefit in adult septic shock. But, there is insufficient evidence to make a recommendation for colloids in pediatric septic shock.
BEYOND FLUID AND VASOACTIVE AGENTS

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Sepsis has clinical, social, economic and political origins and implications. Care for sepsis is plagued by delays in recognition and in many cases basic procedures are not followed. Beyond the issues related to recognition and treatment are social and economic barriers to care in the developing world. These include poor health seeking behaviour because of lack of education and money, and faith in supernatural causes and home remedies. Other barriers include long distances and non-availability of transport as well as many stops and long waiting time. In addition, lack of empowerment of women in many parts of the world results in poor health seeking care behaviour for their children (31). In many parts of the developing world there are also a low emphasis on preventative services, staff shortages and inequity of health care and poorly regulated managed health care sectors.

One of the major barriers to sepsis care in resource limited areas is education of healthcare workers. In many cases specialists are unavailable and much of healthcare is delivered by village health workers, nurses and general practitioners. Thus we need tailored training for teams with limited medical skills and knowledge base. Beyond training, innovative solutions in building capacity to prevent and treat sepsis in resource poor areas are needed. Building capacity entails several factors including increasing community engagement, strengthening competencies at all levels, adapting guidelines based on available resources and best current evidence, use of innovative technologies for diagnosis and treatment as well as strengthening transport and referral systems.

There are other innovative solutions such as intervention packages used by child health workers which has resulted in reduced neonatal mortality, and reduced drug overuse and increased early treatment for pneumonia and malaria. The provision of low cost antibiotics, child health workers, day clinics and home treatments have revolutionized care and saved lives in many environments (Pakistan, Bangladesh, Egypt, Ghana and Vietnam). In addition, global child sepsis initiatives, as well as clinical pathways and guidelines, should take into consideration the resources that are available to treat infections in many areas.
OPTIMAL THERAPEUTIC GOAL AND TARGET

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Sepsis continues to be a leading cause of morbidity and mortality in children despite improved understanding of the pathophysiology and clinical management. The cornerstone of therapy in sepsis and septic shock is to maintain adequate oxygen delivery in the presence of myocardial depression, capillary leak, acidosis and massive cytokine release. Restoration of tissue perfusion should be targeted to therapeutic endpoints that include normalisation of heart rate, normal pulses with no differential between central and peripheral pulses, warm peripheries with capillary refill time of less than 2 seconds, normal mental status, and urine output of more than 1 ml/kg per hour. Other therapeutic goals include improvement in lactate to levels less than 4 mmol/L, central venous oxygen saturation (ScvO2) > 70 percent and cardiac output of 3.3-6 L/min/m². Cardiac output monitoring can be obtained via various methods and provides measurements of cardiac output as well as systemic vascular resistance, but there is no good evidence for improved outcome with these tools. Despite these new tools, progress towards clinical targets is still important to monitor adequacy of therapy.
Bacterial infections caused by antibiotic-resistant organisms are common health concern in pediatric intensive care units (PICUs). Hospital-acquired infection is an increasing problem in intensive care units, where the patients are more susceptible and the organisms often more resistant than in other environments. The majority of PICU patients receive antibiotics for suspected bacterial infections that were not definitively confirmed by laboratory tests. The prevalence of resistant pathogens varies between countries and units and over time in the same unit. Therefore, it is important to know local epidemiology of major pathogens frequently identified in that PICU and their patterns of antibiotic susceptibility.

Within the PICU, timely and appropriate empiric antibiotics can improve outcomes in critically ill patients with infection. The treatment of serious bacterial infections is complicated by the fact that time to initiation of effective antimicrobial therapy is a strong predictor of mortality. Therefore, therapy must be initiated before the causative pathogen is identified. However, inappropriate or inadequate initial empirical therapy is associated with increased mortality, morbidity, and length of hospital stay. Initial empirical therapy with broad-spectrum antimicrobials attempts to provide treatment active against the most likely pathogens until culture/susceptibility test results are obtained. After the causative pathogen is identified, streamlining to more-precise therapy of the shortest acceptable duration is implemented. It is also important to emphasize to discontinue the antibiotics when the clinical progression, laboratory, and culture results do not support a bacterial etiology.

In summary, start with a broad-spectrum antibiotics and modification to pathogen-specific treatment can decrease the risks of death, morbid complications, increased duration of hospital stay (as a result of ineffective initial treatment), and emergence of resistance (due to extended treatment with broad-spectrum agents).
CRITICAL CARE AFTER NEUROLOGIC SURGERY

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Intracranial pressure is determined by the total force exerted by the brain, blood, and cerebrospinal fluid contained within the fixed volume of the skull. Raised ICP is both the consequence and the cause of damage to neural tissue from the primary injury or delays in treatment. ICP control is an integral part of neuro-intensive care after neurosurgery. Despite the varied causes of increased ICP, its acute management is largely independent of etiology. The mainstay of therapy for patients with increased ICP is the maintenance of optimal hemodynamic and respiratory support to ensure adequate oxygenation and perfusion of the brain. Neuro-imaging is a priority, although those patients with a herniation syndrome should be treated urgently before confirmation of brain herniation. Neurosurgical assessment is warranted urgently in all patients with suspected increased ICP. This talk intends to identify those patients at risk of intracranial hypertension and present a framework for the emergency investigation and treatment after neurological surgery.
SURGICAL APPROACH TO UPPER AIRWAY NARROWING

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Misjudgement and/or mismanagement of an airway problems leads to the literally fatal results in children, particularly with upper airway problems including trachea. In these circumstances, surgical approach means to secure the direct entrance of oxygen to trachea (such as tracheostomy), and also means to create the adequate pathway of oxygen to both lungs (such as tracheo-plasty).

If we take the different point of view, to make the direct uptake pathway of oxygen to blood (such as implementation of respiratory ECMO: extracorporeal membrane oxygenation) should be recognized as one of the surgical methods to the upper airway narrowing or obstruction.

In this presentation, I would like to show
1) characteristics of airway anatomy and respiratory physiology in children
2) preparation of medical team for emergent airway in children
3) pre-operative management of tracheal stenosis and tracheo-plasty
4) respiratory ECMO support in children with upper airway obstruction

For adults, we have several choices for emergent surgical procedure to secure the airway not only for surgeons but also for emergency physicians or intensivists. However, in children particularly in infants, classic tracheostomy in emergency settings is somewhat difficult for emergency physician or intensivists, and sometimes even for surgeons. There is a lack of adequate size of percutaneous devices for infants. Because of these backgrounds, we have to prepare for the good collaborative teams with paediatric surgeons and/or ENTs, and also with paediatric anaesthesiologists in advance.

Tracheal stenosis is not a common disease, but causes significant respiratory difficulty and rapid deterioration. Need to know the adequate strategy for the ventilator settings and endotracheal tube management to avoid further idiopathic complications. Surgical indication and details of procedure depend on each institution, but I will show the standardized management protocols of my institution in this presentation. Helium inhalation would be possible adjunct treatment for these settings.

Respiratory ECMO should be the life saving method for the significant airway narrowing. We could offer emergency implementation of respiratory ECMO cannulation by Seldinger method percutaneously by intensivists. Would not be a good choice for arrested patients, but might be considered for witnessed in-hospital cardiac arrest victims caused by known airway narrowing. For deteriorating cases with known airway narrowing with secured airway should be good indication and should not loose by hesitating implement respiratory ECMO in emergency fashion.
ISSUE AFTER LIVER TRANSPLANTATION

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Pediatric intensive care unit (PICU) plays a critical role in the immediate post-operative management in children with liver transplantation (LT). It is because coagulopathy, hemodynamic status, renal function, pre-operative conditions, and intensive immunosuppression may complicate patients’ recovery. In addition, surgical complications such as hepatic artery thrombosis should be managed immediately and properly in PICU. Biliary atresia and acute liver failure are the most common indications of pediatric LT. PICU care should be individualized based on the indications of transplantation (chronic liver disease vs. acute liver failure). The treatment cannot be generalized, because each center has its own strategy and excellent experience. We will talk about the role of PICU in the postoperative management of LT.
COLLABORATIVE RESEARCH NET-WORK IN ASIA - FEASIBILITY AND BARRIERS

Jan Hau Lee

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There is an urgent need for collaborative pediatric critical care research. Specific challenges in conducting studies in critically ill children include patient heterogeneity, low mortality rates and low parental consent. Collaboration potentially can help overcome these hurdles. However, challenges and barriers do exist in sustaining meaningful and strong collaboration within the pediatric critical care community. In this session, we will describe some examples of ongoing collaborative pediatric studies, highlight advantages and barriers to collaborative research and propose potential solutions to help setting up pediatric critical care networks.

There are an increasing number of multicentre research studies in pediatric critical care over the past decade. These studies have contributed meaningful data to important conditions such as acute respiratory distress syndrome and septic shock. However, collaborative research is not present uniformly across the different geographical regions. There is marked heterogeneity in disease processes, patient demographics and clinical resources across regions. International research networks can provide platforms to address these differences.

Collaboration brings about many advantages. Multiple centers are able to recruit a larger number of patients, thus increasing sample size and power of proposed studies. By involving sites from different regions, results have greater generalisability and potentially higher impact. Collaboration allows for clinicians and researchers to share resources, identify differences and provide platforms for quality improvement initiatives. Despite these potential upsides, challenges and barriers exist in the process of forming collaborative research groups. These challenges include the lack of underlying motivation to form networks, divergent research priorities, inherent time and energy constraints of clinicians/researchers, and lack of sustainable funding.

There are potential solutions to increase research collaboration. Clinicians and researchers need to step out of their comfort zone, make use of current available technology, and be realistic of initial research goals and outcomes to take the initial first few steps in establishing such networks. Guidance and mentorship from established leaders from other networks will provide further support in the right direction.

Collaboration is essential in moving pediatric critical care forward. There is a pressing need to form sustainable national, regional and international networks. By addressing potential pitfalls and barriers early, the pediatric critical care community can begin to take small steps in establishing sustainable multicentre networks across the world.
BRINGING EVIDENCE-BASED PROTOCOLS TO THE BEDSIDE: BARRIERS AND STRATEGIES FOR IMPLEMENTATION

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When protocols are implemented into our practice, the following factors should be considered;

1. Does this protocol have high priority in our practice? Does it potentially improve the outcome?

2. Does the protocol fit the team? The protocol requiring big manpower may not be applied in the team with limited manpower.

3. Do all the team members understand the protocol? If physicians dislike the nursing protocol or if nurses disagree with the physicians order, the protocol does not work.

4. Does the scientific evidence support the protocol in pediatrics? The evidence in adult population sometimes may not be applied in pediatrics.

5. Is the evidence truly correct? The evidence by large randomized controlled trials has been denied by the other studies later on in the field of critical care.

Once the protocol is implemented, evaluation at a certain interval is required. Implementation strategies in pediatric critical care will be discussed.
IS BIGGER BETTER? DOES PICU VOLUME IMPACT OUTCOME?

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The care of critically ill and injured children requires teams with specialized expertise and knowledge and has led to the development of Pediatric Intensive Care Units world-wide. There are reports demonstrating improved patient outcomes and lower costs for certain high-risk and/or highly complex surgical procedures in centers with increased surgical volume including pediatric surgical management of congenital diaphragmatic hernia and Hypoplastic Left Heart Syndrome. In addition, this relationship between improved outcomes and center volume has been shown in other conditions (adult and/or pediatric) such as trauma, respiratory failure, and Extracorporeal Membrane Oxygenation leading to efforts at regionalization of pediatric critical care in many countries. The factors contributing to this improved outcome are likely multi-factorial but may include increased availability of resources including specialists, ongoing exposure of staff to the specific disease process, improved efficiency of care delivery, and decreased variability in care processes.
FLUID MANAGEMENT IN CRITICALLY ILL CHILDREN

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Fluid management is an important aspect of paediatric intensive care. While the basic principle is to maintain an adequate intravascular volume to provide a good cardiac output for better organ perfusion, and at the same time, avoid excessive fluid overload in the extravascular compartment, it is always a challenge. Impaired renal function is commonly encountered in hypotensive patient. If the underlying hypovolemia is not identified and corrected, it can progress to irreversible renal failure for which renal replacement therapy might be needed, thus increasing the complexity of care which will further increase in mortality and morbidity of the critically ill patient. In septic shock, rapid and vigorous fluid resuscitation in the initial phase is important for better survival. At the same time, release of inflammatory mediators during sepsis might cause more tissue edema. Patient might appear puffy and yet the intravascular volume is still inadequate. For gastrointestinal operations, increase third space fluid loss might need additional fluid supplement. Fluid loss through drains, stomas can be quite significant. Additional fluid supplement should be considered if volume is greater than 30ml/kg/day. On the other hand, fluid overload is reported to be quite common. In sick patient, they can develop syndrome of inappropriate ADH. If the fluid maintenance is based on normal fluid supplement, they can easily develop fluid overload and hyponatremia. For cases on ventilator with heated humidifiers, fluid adjustment is needed as the insensible water loss through the airway is much decreased. Close monitoring of fluid balance, the central venous pressure, left and right ventricular function and intravascular volume by ultrasonography, the electrolytes, acid base status, and other parameters are necessary for an optimal fluid balance.
PREVENTION OF ACUTE KIDNEY INJURY

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Acute kidney injury (AKI) in pediatric patients has been usually defined as an increase in the measured serum Cr and a decrease in urine output, and the incidence of AKI in the pediatric intensive care unit (PICU) has been reported as increasing to 25%, depending on population characteristics. The etiology of AKI has changed over the last 10-20 years from primary renal disease such as hemolytic uremic syndrome or glomerulonephritis to the renal conditions associated with systemic illness such as sepsis or cardiac surgery. The AKI in pediatric population is associated with increased mortality and morbidity, and prevention is needed to reduce the consequence of AKI.

It is known that the most important risk factors for AKI in the PICU are clinical conditions to be associated with decreased renal blood flow, direct renal injury, and illness severity. Renal hypoperfusion leads to neurohormonal activation including renin-angiotensin-aldosterone (RAS) system, sympathetic nervous system, antidiuretic hormone, and prostaglandins. These activations result in systemic vasoconstriction and renal effects such as efferent arterial vasoconstriction, afferent arterial vasodilation, maintenance of glomerular capillary pressure and salt and water retention. Prolonged renal hypoperfusion can result in acute tubular necrosis. The direct renal injury can be predisposed under the condition of renal hypoperfusion, and appropriate treatment of volume depletion is important to prevent AKI. The preventable causes of AKI include contrast-induced nephropathy, hemodynamic instability, inappropriate mediation use, and multiple nephrotoxic insults. The nephrotoxic agents including renin-angiotensin-aldosterone inhibitors, non-steroidal anti-inflammatory drugs, or calcineurin inhibitors have been known to be responsible for pediatric AKI. Given the evidence of preventable factors for AKI, several actions such as the use of protocol for prevention of contrast-induced nephropathy, appropriate treatment of volume depletion, vigorous treatment of sepsis, avoidance of combinations of nephrotoxic medications, and monitoring of levels of drugs should be recommended.
Acute kidney injury (AKI) is related to patient mortality and therefore critically ill children who develop AKI need to receive early intensive care to prevent complications. Factors influencing patient survival have been reported to be low blood pressure at the onset of renal replacement therapy (RRT), the use of vasopressors during RRT, and the degrees of fluid overload at the initiation of RRT. Early intervention of continuous RRT (CRRT) has been introduced to reduce mortality and fluid overload that affects poor prognosis in patients with AKI. As the technology of CRRT and clinical practice has been advanced, experiences using CRRT on small infants and neonates have increased. Recently, the Cardio-Renal Pediatric Dialysis Emergency Machine (CARPEDIEM) CRRT machine was introduced to provide various treatment modalities and support for multiple organ dysfunction in neonates and small infants.

In addition, critically ill children receiving extracorporeal membrane oxygenation (ECMO) therapy need strict volume control, requiring CRRT. However, the best methods for the concurrent CRRT application in children receiving ECMO have not been established yet. CRRT can effectively be applied to children, but there are many limitations in clinical practice for them such as vascular access, bleeding complications and lack of neonate-specific devices. Moreover, the data on pharmacokinetics of drugs and nutrition in children receiving CRRT are lacking. Considering the rarity of pediatric AKI, multicenter study is required to perform prospective randomized trials to evaluate the effect of CRRT dose and modality on patient outcome and to assess CRRT pharmacokinetics in the future.
RESUSCITATION: FROM PREVENTION TO ADEQUATE CARE

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CPR is aimed to provide re-circulation as soon as possible, to allow for treatment of the underlying condition, with the aim of recovery of health or an acceptable quality of life. That is, the goal is not merely the resumption of circulation and breathing. CPR is not meant to be an instance to prolong the dying process or agony, and therefore, limits must be set.

Resuscitation as a concept is wider than CPR, aiming for a recovery of homeostasis as soon as possible.

Early detection and management of patients in risk of requiring resuscitation has been the factor with the highest impact in prognosis. The time factor is crucial.

For prevention, education and adequate access for all children to health services is the basic to improve outcome. Strategies to focus resources round the world include an adequate diagnosis of predominant causes leading to the need of resuscitation. Advances include policies such as access to clean water, drainage, nutrition and immunization programs. Sanitary decisions include access to health care and resources to treat common events: fluids, oxygen and antibiotics between the first.

In Neonate care a conservative, less invasive resuscitation with lung protective strategy, from the Delivery Room on, has improved outcome and reduced short and long-term complications.

Chile improved the rate of its healthcare indicators organizing a national network with progressive care up to high complexity, including a transport system. For winter outbreaks of respiratory diseases, the country developed a yearly national campaign with allocated resources allowing early access for all, with a reduction of morbi-mortality during the last decade. Great burns, septic shock, severe trauma, neurosurgery, or those patients requiring vital function replacement (including hemofiltration and ECMO), are referred to units were expertise is accumulated and resources are available.

The quality indicator rate of resuscitation manoeuvres and arrests, in the pre-hospital and in the hospital pre-PICU setting, is a measurable indicator to see how things are working.

Adequate care of critically ill patients has been a main worldwide goal, searching for appropriate resuscitation strategies. It included the Early Goal Directed Strategy in sepsis since the last decade, to define objective end points to aim for, looking for a balance between oxygen delivery and tissue demand in shock or after arrest. The merit was an enhanced emphasis on monitoring, volume replacement, antibiotics and vasoactive drugs, improving outcome in children. Later studies evidenced the need for new goals enriched by expertise.

ECMO and hypothermia as strategies to improve outcome and reduce sequelae after resuscitation are in constant analysis.

Sudden death and resuscitation during childhood and adolescence is another topic. Routine yearly medical evaluation of all children is desirable, in order to detect conditions whose appropriate diagnosis and management should prevent or reduce the risk.
RAPID RESPONSE TEAMS’ SAVE LIVES!

Barry Markovitz
Children’s Hospital Los Angeles, United States

Rapid Response Teams (RRTs) are specialized groups of highly skilled clinicians (usually PICU physicians, nurses, and/or respiratory therapists, though the composition may vary) that can be called quickly to respond to deteriorating non-ICU hospitalized patients. With vast experience and data that outcomes after inpatient cardiorespiratory arrest are dismal, and that many such events are potentially preventable, the face validity of early recognition and intervention (rescue) of such patients has been undeniable. The evidence, however, that RRTs can prevent cardiorespiratory arrests and reduce mortality has been variable. In childrens hospitals, several initial reports suggested significant reductions of non-ICU cardiorespiratory arrests and even total hospital mortality. Subsequent studies have been more equivocal.

RRTs are only the efferent limb (in the typical reflex arc analogy) of a system-level strategy to improve the recognition of and response to deteriorating inpatients. Without a proper early recognition system in place (the afferent limb), failure to rescue patients will continue. It is only through thorough, institution-wide educational efforts and culture shifts over time that a proper early warning system and rapid response team system can take root and hope to have meaningful, lasting effects to improve patient safety and outcomes.

The evidence of effectiveness of RRTs and strategies for successful implementation and maintenance will be presented.
TRANSPORT OF THE CRITICALLY ILL CHILDREN

Naoki Shimizu
Tokyo Metropolitan Children’s Medical Centre, Japan

Transport medicine is one of the crucial, but a neglected medical field. Without expert personnel, adverse events are high because of the complexity of critically ill patients particularly in children. Many emergency departments and/or many paediatric intensive care units have been trying to sophisticate this medical field in several countries. However, lack of resources tended to be used as an excuse for the lack of adequate transport services, and sick kids are still in the risks. Sometimes, the difficulty of transport and the lack of adequate technology are used as another excuse for giving up kids life and resulted in death.

There are several dimensions when we describe transport of the critically ill children. First, to deal with stabilization and continuous critical care from the referring hospital to the destination, we have to be skill-full from paediatric critical care point of view. Second, to deal with swiftness and administration of several transfer logistics, we have to be knowledgeable from emergency service point of view. And finally, to deal with complexity of care based on advanced technology, we have to set up multidisciplinary teams.

In my institution, our department is composed of two divisions, emergency medicine and paediatric intensive care medicine. Transport services were launched as a collaborated programme of these divisions to bring advantages from each other. Currently, we are running several hundreds of transport cases per year. Most of them are running by emergency division solely, but several severe cases require the combination of both divisions.

Recently, we have launched acute respiratory failure transport programme. We offer not only respiratory ECMO (extracorporeal membrane oxygenation) transport but also offer HFOV (high frequency oscillatory ventilation), inhaled nitric oxide (iNO) therapy, and other advanced technologies. We send medical personnel including emergency and intensive care expert, surgeons, nurses and technicians, as a multidisciplinary team. We send them not only for completing transport missions but also for offering medical advice and support on site. With regards to the ECMO transport, although it is common in several countries, we have successfully done the first paediatric case last year. To reach this success, we crossed several processes such as simulation transport, intra-hospital transport, setting up manuals, etc.

EMS (emergency medical services) systems are pretty different from those in other countries. Japanese EMTs (emergency medical technicians) cannot offer advanced procedures for children less than 15 years old. They cannot intubate them, cannot insert intravenous/intraosseous needles, cannot defibrillate manually, etc. Because of these circumstances, our emergency division started physician dispatch transport services to the scene. Some emergency institutions are holding physician directed helicopter services. We have been cooperated with this advanced transport systems for paediatric trauma cases.

In this presentation, I would like to show these activities including ECMO or other advanced transport systems. At last, I would like to touch to the family and ethical consideration on transport.
DO PROTOCOLS AND CHECKLISTS IMPROVE PICU OUTCOMES?

Kyung Won Kim

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Medical knowledge has saved many patients but it can be a burden to health care professionals. Checklists and protocols are important tools in ensuring consistency of care and reduce omission errors, inappropriate variation and human errors under stressful conditions while expediting effective advances to everyday practice. The use of checklists or protocols has been shown to improve patients safety and the quality of medical care. However, checklists or protocols alone do not guarantee success and they must be implemented in an effective and consistent manner. Excessive use of checklists or protocols can become a hindrance, a burden or a risk infringing on efficient clinical judgment. Careful selection of topics, consideration of clinical feedback in the content process design and consistent use can help avoid potential downfalls.

Here I will review checklists and protocols, which are successful or even not, in intensive care units especially pediatric units, and demonstrate how to ensure they are delivered effectively and consistently in practice.
VAP - ELIMINATION: CAN BUNDLES MAKE A SIGNIFICANT DIFFERENCE?

Joongbum Cho

Samsung Medical Center, Sungkyunkwan University School of Medicine, Republic of Korea

Ventilator-associated pneumonia (VAP) is defined as pneumonia occurring more than 48 hours after the initiation of mechanical ventilation. It is one of the most common hospital-acquired infection in the intensive care unit (ICU). The quoted incidence of VAP rages between 5 and 67% and the mortality rates of VAP may exceed 10%.

VAP prevention has been assessed as a quality indicator for ICU and many strategies have been applied to decrease the incidence. Institute for Healthcare Improvement (IHI) developed a care bundle which includes 1) Elevation of the head of the bed to 30-40, 2) daily sedation vacation and daily assessment of readiness to extubate, 3) peptic ulcer disease prophylaxis and 4) deep venous thrombosis prophylaxis. There are many preventive measures that can be included in VAP bundles, such as oral care with chlorhexidine, subglottic suction endotracheal tubes, continuous control of endotracheal tube cuff pressure, silver-coated endotracheal tubes, probiotics and selective gut decontamination.

The answer of what are the best components of such bundles is not known yet. A pan-European Committee suggested 5 preventive measures: no ventilator circuit tube changes unless specifically indicated; strict hand-hygiene using alcohol-based rubs; appropriately educated and trained staff; sedation vacation and weaning protocol; and oral care with chlorhexidine.

In many studies, the implementation of the VAP prevention bundle decreased VAP rate, but they fail to show differences in mechanical ventilation days or ICU length of stay or ICU mortality with some exceptions. There is still no useful gold standard for VAP diagnosis, which makes the VAP rate difficult to be compared among studies. Clinical outcomes such as antibiotics consumption, ventilator days, ICU days, ICU mortality need to be studied more as a primary endpoint to decide the usefulness of VAP bundle.
Critical care is still a rare, precious and expensive resource all over the world. A rational access with clear goals is necessary, trying to achieve an early admission, when really necessary, for all children who could benefit. PICUs in scarce-resource countries, with still high infant mortality rates due to other not solved sanitary conditions, are a challenge for the health team who has to work normally in very precarious environments. PICUs are economically demanding, and the benefits are for few individuals. Resources will ever be scarce, in any country but on different levels, in the context of a demanding society, fast new emerging medical knowledge and development and availability of new technology.

A well-organized progressive care organized as a network in cities and ideally every country, is important, avoiding a late admission for each patient to be cared for.

Admission criteria to PICU, together with basic rejection criteria, are important and may be explicit mentioned in the guidelines of any institution.

The time between the request for admission from the Emergency Department and the arrival in the PICU-bed is a valuable criterion, reflecting availability and the quality of the admission process. In our unit around 90% enter in ≤ 1 hour. All the delays are analyzed.

Other measurable criteria related to the process of admission but also opportunity of discharge is readmission in a given period (72 hours).

The registration of pre-PICU arrests, or the number of patients requiring advanced resuscitation also contribute to the information necessary to improve the organization.

Not availability of a PICU-bed, subspecialists, technology, or expertise for some procedures, is a reason for rejection. Also bioethical reasons may be mentioned as a reason for rejection, in an effort to limit PICU to children who should have an expectable benefit. In our institution the rate of pre-ICU LTE (denied entrance) is around 0,01-0,02 % of the hospital admissions.

The rejection rate is part of quality assessment. It can be divided into intra-hospital (internal demand) and extra-hospital (denied transfer from another facility), reflecting different problems.

Discharge criteria are also multifactorial. Guidelines based on clear accepted indications for access and stay in critical care, and his limits after management, facilitate this job. Similar to admission, clinical, administrative and bioethical reasons are involved. Delay in discharge due to insufficient step-down facilities, measured in days, impact on the rotation index and future organization. It is a signal for an imbalance between PICU and ward beds.

The mentioned measurable criteria for admission, rejection and discharge, between others, are registered on daily basis in our PICU since 2004. The results were the argument for significant changes: we added in 2008 21 Intermediate Care beds to the 14 Intensive care beds, modified the guidelines for admission and discharge, could purchase new equipment, correct internal processes and require subspecialists lacking for some procedures to satisfy the real local demand. Results improved as a consequence.
OUTCOME EVALUATION - QUALITY OF LIFE OF PICU SURVIVORS

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National University of Malaysia, Malaysia

Paediatric intensive care has changed over the past 2 decades. More children with complex and chronic medical conditions are offered intensive care. Advances in mechanical ventilation as well as artificial organ support systems have also led to lower mortality rates in paediatric intensive care units (PICU) and more critically ill children are not surviving. Hence survival after intensive care admission is now not the only outcome of interest. Evaluation of physical and psychological sequelae as well as quality of life of survivors and their families has become increasingly more important. Furthermore, the high costs of intensive care needs to be equated with benefits to the patients. Several issues that require consideration in determining the outcome of children after PICU admission have been described. These include identification of purpose of outcome assessment, choice of tool to use, case-mix, severity of illness, length of stay and collection of data. Various tools are available for the evaluation of functional outcome and quality of life such as Modified Glasgow Outcome Score, Pediatric Overall Performance Category and Pediatric Cerebral Performance Category, and Health Utilities Index Mark 3. The outcome of an individual child is dependent on many factors, including patient factors such as diagnosis, pre-existing health problems and severity of illness, as well as the ICU standards and available treatments. Social and cultural factors with regards prolonged care and limitation of care would also affect outcome. These factors have to be taken into consideration when attempting to compare outcomes between units and also over time. There is evidence indicating that long-term outcome in terms of quality of life after paediatric intensive care admission is good or normal for the majority of surviving children. Some studies though, have shown greater proportion of survivors with moderate and severe disability increasing significantly through the years. The outcome status of an individual patient has also been shown to change over time. Outcome evaluation is important to assess the effectiveness of paediatric intensive care over time, within a unit as well as for comparing between units.
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Step-up Session
MANAGEMENT OF INTENSIVE CARE UNITS IN GHANA

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37 Military Hospital, Ghana

Ghana is on the west coast of Africa with the most thriving democracies on the African continent. Ghana is a country with 227,533sq km land area. The population with 2013 population census is 25,199,609 and population growth rate is 1.25%. Critical care Medicine is a new area evolving and the Ghanaian health professionals are yet to embrace it.

OBJECTIVE
The goal of this study was to review and provide an overview of that is unique to intensive care units in Ghana.

METHOD
There are 5 multipurpose intensive care units and 1 cardio thoracic intensive care unit in the ten regions of Ghana. All the 6 intensive care units were reviewed. The criteria for review were availability of professionals, attitude towards practice, available equipment and consumables and mortality rate. The 37 Military Hospital ICU was used as the criteria for evaluation hence was put in perspective.

CONCLUSION
Each intensive care unit had its own challenges but majority of units had similar problems which were non-availability of educational scholarships, proper equipment and consumables to improve inputs and improper supervision. Each ICU has its own admissions criteria and the cost of ICU care deters people from receiving such care. There are few patients who benefited from ICU care. The scarcity of intensivist was also as a challenge. Despite challenges, there has been tremendous improvement in training critical care nurses over the past years with Anesthesiologist and/or emergency medicine specialist being leaders of the team for the ICU. There are also dedicated professionals who are working had to improve critical care practices in the country AND ENTICE MORE PEOPLE TO JOIN CRITICAL CARE MEDICINE.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN NIGERIA

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Introduction

Critical care is an expansive term that incorporates all areas of high intensity care. While intensive care is included under this umbrella term, other acute areas such as, but not limited to, emergency departments, recovery rooms, and coronary care units are covered also. Intensive care nursing is the recognized term for critical care in Nigeria. This article describes the history, the types and current status of ICUs, the challenges, and academic training and certification in critical care medicine in Nigeria.

There is a global disparity in health care, capacity for research, and inability to deliver the care provided by critical care medicine to the majority of the Nigeria population raises ethical concerns. Only Sixteen (16) hospitals with an average of eight (8) beds per ICU, and a few private hospitals, provide Intensive Care services, in majorly teaching centers to a population of over 160 million people.

The foremost challenge is to aim resources at those patients likely to survive, and not to be used as an extension of the general floor, not as a V.I.P. unit for just the rich and mighty. Mostly poorly equipped units with lack of facilities for standard procedures. Lack of good maintenance culture, with no trained Bio medical staff. Inadequate staffing to meet the minimal standard, medical doctors trained intensivists are hard to come by. Those in acute care are not sensitized to what critical care is all about. We are still struggling to have our intensive care certificates quantified. Lack of constant water and electricity are still big issues to worry about.

Conclusion

All of the above notwithstanding, lives are still being saved, disabilities are being averted, and with competent, tactful, compassionate, hardworking and alert practitioners, quality care is being offered daily to those in most need of this special care.

The upgrading of critical care training in Nigerian universities and maintenance of high standard of critical care services are the cardinal goals and vision of National Association of Nurse Intensivists of Nigeria (NANIN).

Keywords: Critical Care Medicine, NANIN, Nigeria
NURSING EXPERIENCES OF CARING FOR BURN PATIENTS WITH SEPSIS IN CRITICAL CARE UNITS IN SOUTH WEST ZONE, NIGERIA (CASE STUDY: NOHI, LAGOS)

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The aim of this study was to explore and describe the nursing experiences of critical care nurses who look after critically ill burn patients with sepsis. The objective was to develop incident care package after a heavy bed state section of the unit.

Background/purpose: The goal of patients critical care is survival. The nursing aim is to enable the patient recover. Despite the application of standard precaution towards infection prevention/control, burn patients get infected (21% of admitted cases in 2014) in our acute burn unit.

Inspite of the application of modern technologies and intensive therapy, burn patients with sepsis present a very poor prognosis, exposing the nursing team to physical repercussions of stress and eventual grief.

Methods: A Heideggerian phenomenal approach was adopted. Ten registered Nurses; 5 trained in critical care and 5 trained in burns and plastic nursing were interviewed in 2014. A semi structured approach with interview topic list was administered.

Examples of the questions were: Could you remember a time when you nursed acute burn patient who developed sepsis while in the unit? How did you feel? Why was this case peculiar to you? What where the challenges militating against your efficient nursing responsibilities? Interviews were recorded with an audio tape and then transcribed verbatim. Athematic analysis was carried out using colaizes framework.

Results: Generally 5 key themes were identified. Sepsis in burn patients generate chronically ill patient in CCU. First aid culture; a pre-cause to infection, work related stress, compassion fatigue, financial embarrassment and sourcing for materials.

The participants described how worrisome it is to carry out dressings rigorously in a large total burn surface area with little or no improvement. They expressed grief as they helplessly watched the vital organs fail due to lack of funds to purchase antibiotics and surgical dressings, lack of appropriate technology, ambiguous policy of no pay no drug supply and inability to register any healthy suggestions that could improve the care. Shorter M & Staytl C. (2010) describe their innermost feelings for distressed patients. The participants had nursed burn patients (of 30-92% TBSA) with sepsis personally and over the years not less than five (5) years.

Conclusions: Confronting death and dying is inevitable in burn patients with TBSA of burns (25% and above) with sepsis as complication. The aged (55 years and above) had highest incidence (88%). Their long inpatient days (averagely 26days) in acute burn unit and eventual death outcome made Nurses describe a system of job monotony. Poor patient outcome leads to occupational stress and ultimate burnout which leads to brain drain and subsequent shortage of Critical Care Nurses in Nigeria.
CURRENT STATUS OF CRITICAL CARE NURSING/MEDICINE IN ZAMBA

Universe Mulenga Himoonga

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Zambia has a population estimate of 15.2 million people (WPR 2015) and these are served by 1,956 health facilities (MoH 2012) out of which 109 are hospitals with intensive care units (ICU). The country’s frontline workers the Nurses, assigned to work in these ICUs, remained untrained in key knowledge to help them function effectively in the ICU and high dependence areas. The School of nursing at the University Teaching Hospital, (UTH) identified the need to develop faculty and curriculum in critical care nursing as an inevitable reality.

At the country’s biggest referral hospital, the UTH, with a 10 bedded intensive care unit only one trained ICU nurse was available before the project. The scenario made it inevitable for this trained nurse to start informal training of other general nurses to ease the burden. From this back ground the faculty at the nursing school looked for an opportunity to develop formal ICU training. Educational Partnership with Brighton University School of Nursing and Midwifery and University Teaching Hospital Lusaka School of Nursing started in 2009 and out of this partnership, a curriculum for Critical Care Nursing was developed.

AIM OF THE PROJECT: The aim was two fold
1. Develop a national Critical Care Nursing workforce.
2. Design a professionally endorsed and locally delivered curriculum, developed through educational partnership.

Methods: Ridding on the existing Lusaka Brighton link, established in 2005, linking Brighton and Sussex University Hospitals NHS trust, and the University Teaching Hospital School of Medicine in Zambia, the Lusaka School of Nursing was linked to Brighton University School of Nursing. Overall goal of above link was to build capacity in health systems in Zambia, based on identified priorities. Under the sponsorship of the British Council - Education Partnership in Africa, the project was initiated in 2009, faculty underwent training for 5 months to build capacity to design and deliver a CCN curriculum. Mentorship, information literacy training, and exchange programmes between partners strengthened the faculty. Faculty engaged the Nursing Council to tailor curricula to local design and endorsement. Final approval to commence program was achieved in 2012.

RESULTS: A national Critical Care Nursing Curriculum was developed and approved by the regulatory body and government through the Ministry of health in 2011. The first cohort commenced training in January 2012 and the teaching was supported by faculty exchange visits and to date 81 critical care nurses have been trained locally. Sustainability plans, Government committed itself to develop the faculty for CCN programme as a sustainability measure. So far, one lecturer has completed her masters in CCN while three are still in training. This particular partnership, led to another link which developed another curriculum, the paediatric nursing curriculum which was approved in 2014 by the regulatory body.

Conclusions: Ridding on MDG 6, whose aim was the attainment of universal health coverage on HIV treatment, the School of Nursing at the University Teaching Hospital developed the critical care nursing curriculum, through global partnership. Brighton and Sussex University Hospitals NHS trust, its academic partners linked the two Colleges of nursing and the development of the critical care nursing curriculum was identified as a special need by the faculty on the Zambian team, contributing to the attainment of the MDG goal No 8, b, [global partnerships for development to address the special needs of the least developed countries, UN (2008)].
CURRENT STATUS OF CRITICAL CARE MEDICINE PRACTICE IN EGYPT

Akram Muhammad Fayed

University of Alexandria, Egypt
IMPROVEMENT IN INTENSIVE CARE UNIT OUTCOMES AT A TERTIARY INSTITUTION: CAUSES AND EFFECTS

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Lagos University Teaching Hospital (LUTH), Nigeria

Background: The Lagos University Teaching Hospitals Intensive Care Unit (ICU) was founded in 1975. It sits on the same floor as the modular theatre. It is an 8 bedded ICU. Presently run as a 5 bedded ICU with a potential sixth bed. In order to improve standard of care, ABG machines, monitors and ventilators were provided for the ICU. We compared the number of admissions into the ICU, the mortality and discharge rates in the previous year and the year after the upgrade of the ICU facilities.

Methods: This was a retrospective study of all patients admitted into the ICU over the period June 2011 May 2013. We looked at the admission register of the Intensive care unit and retrieved biometric data, diagnosis, age, pattern of admission, length of stay and outcome of ICU care.

Result: Demographically Neurosurgery, General Surgery, Obstetrics and Cardiothoracic units have the highest number of admission into ICU over these two year period accounting for 70.6%, of all admissions between June 2011 and May 2012 and 63.5% between June 2012 and May 2013. There was a significant difference in the mortality of patients admitted into our ICU between June 2011-May 2012 and those between June 2012 and May 2013, p=0.02.

Conclusion: We concluded there was a significant improvement in our ICU outcome with the addition of new monitors, arterial blood gas monitors and introduction of single use consumables into the intensive care unit.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN INDIA

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Ancient India was a pioneer in medicine with towering personalities like Charaka contributing principally to the evolution of Ayurveda or Alternative Medicine, and Susruta who devised many surgical techniques like rhino-platy, cataract removal etc.

Modern India is not far behind. The Indian healthcare industry is expected to touch US$ 160 billion by 2017, with current per capita expenditures averaging at US$ 88.7. Development in ICU is one of the major contributors to the Healthcare GDP growth. The Copenhagen Poliomyelitis outbreak in 1952 first spurred the need of intensive care and, even though it required considerable investments, tremendous potential is ensured in saving lives of many.

In India, ICU started (late 1960s) with respiratory care and intensive cardiac care initially. Later, NICU, PICU, Neuro ICU, etc. were developed.

ISCCM established in 1993, after that Critical Care started taking shape in earnest all over India and many guidelines like Organization of CCUs (level 1, level 2 and level 3), Infection control, Transport of critically ill patients, End of life care, etc were crafted - helping prompt development of Critical Care infrastructure and human resources throughout the country.

In India CCU treat variety of patients ranging from polytrauma (RTA 10lakhs/yr in India WHO). Pancreatitis, Sepsis, Myocardial infarction, Endocrinal emergencies to Dengue, Malaria and Leptospirosis, Heat Stroke, Snake bite, organophosphorus poisoning etc. CCU reduced markedly the morbidity and mortality of these patients.

Presently ISCCM courses;
Indian Diploma in Critical Care Medicine (IDCCM)
a one year course for MD/MS/DNB candidates and 2 years for DA/DTCOD or equivalent candidates.
Indian Fellowship in Critical Care Medicine (IFCCM)
a one year fellowship course after completion of IDCCM.
Post MBBS Certificate Courses
a two years course.

ISCCM Diploma In Critical Care Nursing
a one year course for sisters.

The National Board of Examinations, New Delhi, established a Post-Doctoral fellowship in critical care (2yrs). D.M in Intensive Care also started in few universities.

Terrorist Attack, Chemical Disasters and natural Disasters are not very uncommon today. Disaster preparedness is integral to ICUs, both inside and outside. Since 2001, on behalf of ISCCM we have participated in helping disaster affected victims in Gujarat (Bhuj Earthquake 2001), Andaman and Nagapattinam (Tsunami in 2004), Bangladesh (cyclone Sidr, 2007), Myanmar (cyclone Nargis, 2008) etc.

On ISCCM Day public awareness programmes are organized on topics related to Critical Care.

68% of Indian population live in rural areas, for them strong initiatives towards the development of CCU in rural areas have already started throughout the country.
Presently I am involved with West Bengal State Government mediated initiative to launch CCUs and High Dependency Units at secondary and tertiary hospitals in all districts of the state (most of the hospitals are in rural area).

I believe that with adequate thrust by government of India and participation of ISCCM and other organization on preventive and acute measures to negate the spread of deadly viruses (the recent threats) and other diseases even in the remotest rural areas would give a new dimension to the concept of Critical Care in India.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN LAOS

Khamsay Detleuxay
Mahasot Hospital, Lao PDR

Lao peoples democratic republic is one of the Southeast Asia countries and one of the Indochina countries. The population of Laos is about 7 million people. The capital is Vientiane.

Laos is a developing country; the healthcare sector is still need to develop. In Laos, the healthcare delivery divided into grade such as: 5 central hospitals located in Vientiane capital, 17 provincial hospitals, 142 district hospitals.

For the critical care service is more develop in central hospitals, for the provincial hospitals. The HDU is replaced of ICU because of the lack of both equipments and human resources.

The anesthesia, Intensive Care division and the Lao Society of Anesthesiologists try to develop the critical care in Laos by sending the experience doctors from central hospital to help provincial hospital staff in both theory and practice.

In the future, we have a plan to establish the Lao Society of Critical Care Medicine to promote the critical care and gather all critical care doctors throughout the country.

In Laos, we dont have the critical care doctors and critical care nurses, so we have a plan to upgrade our knowledge by sending our staff to study abroad especially in the nearby countries for short training or long term study.
PERCUTANEOUS TRACHEOSTOMY: A CONVENIENT LOW COST SOLUTION FOR RESOURCE POOR SETTING

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Background: Tracheostomy is one of the most commonly performed procedures in the patient receiving long-term mechanical ventilation. While percutaneous dilational tracheostomy (PDT) is becoming increasingly utilized as an alternative to conventional surgical tracheostomy, an analysis of our experience with PDT was performed to determine the advantages, complications and cost effectiveness as ours is the pioneering institute for this technique in the country.

Methods: All the data of patients who had PDT were collected in prospective manner. Dates of hospital admission, ICU admission, intubation, discontinuation of mechanical ventilation, type, location and indication of procedure, procedural complications, charges and patient demographics were analyzed. All the procedures were done by modified Ciaglia technique with SSDT Blue Rhino kit and each kit was reused 4 times on average after proper sterilization to cut down the cost.

Results: First one hundred cases were analyzed which occurred over a period of 20 months after the introduction of the procedure. All except 2 cases were performed with bronchoscopic assistance. No procedure-related fatalities occurred during PDT. The incidence of significant immediate bleeding requiring electrocautery or ligature in patients undergoing PDT was 1%. Transient hypoxemia occurred in 8% of cases and one patient developed significant bradycardia which later on proved to be due to a NSTEMI. No cases of paratracheal insertion, pneumothorax, pneumomediastinum, tracheal laceration or clinically significant tracheal stenosis occurred in patients undergoing PDT. We attribute this low rate of complications to procedural and organizational factors such as bronchoscopic assistance, performance by or supervision of all PDTs by expert physician and airway management by physicians who were well-versed in difficult airway management. The procedure related economic burden was 40% lower for the patient.

Conclusions: Bronchoscopy-assisted PDT is a safe and effective procedure when performed by a team of experienced physicians under controlled circumstances. It has a steep learning curve but can be mastered quickly. Benefit includes elimination of need for patient transfer, management of airway and oxygenation optimally by the same group of physician, less dependency on other specialty like otolaryngology, less peri-procedural bleeding, need for less infrastructural support and less expenses. The complication rates are minimal considering the seriousness of the co-existing conditions. Introduction of the procedure to a new center needs less resource and critical care staff can also be easily trained to perform the procedure. Considering 360 degrees, PDT is not inferior, if not superior to the surgical alternative especially in resource poor settings which may benefit patient immensely.
5 YEAR EXPERIENCE OF CRITICAL CARE MEDICINE IN GHANA

Akwasi Antwi-Kusi
Komfo Anokye Teaching Hospital, Ghana

BACKGROUND: Intensive care medicine started in the 1950s in Europe following the polio epidemic and has since gained importance as a medical specialty in its own right in the developed countries. A lot of resources are dedicated to this area of medicine making it one of the most expensive disciplines in medicine.

In developing countries however, intensive care medicine is not a priority and most hospitals do not have a well established Intensive Care Unit (ICU).

In Ghana the first formal ICU was opened at the Komfo Anokye Teaching Hospital in May 2009 it has 8 beds and we report of a five year experience.

OBJECTIVE: Our objective is to find out the type of patients admitted to the ICU, the diagnosis, number of admissions per year, interventions and procedures done and the mortality rate. We also sought to find the challenges for running an intensive care in our setting.

DESIGN: This was a retrospective study. Data was collected using the ICU admission and discharge book.

SETTING: Ghana is located on the West Coast of Africa, about 750 Km north of the equator on the Gulf of Guinea between the latitudes of 4 - 11.5 north. The Okomfo Anokye Teaching hospital, a 1000 bed hospital is located in Kumasi, the regional capital of Ashanti region with a population of 5,000,000. The hospital was established in 1955 and became a teaching hospital in 1975.

RESULTS: For the five year period, the total number of admissions to the ICU was 1293 making an average of 258.6 admissions per year. 58% of admissions are males and 42% females. 78% of all admissions fall between the age group of 0-50 years. 62% of the admissions were either trauma cases or post operative cases. The average length of stay in the ICU was 3 days. The frequent intervention done in the ICU was mechanical ventilation which accounted for 89% of all patients admitted. Mortality rate was 52.25% with 28% occurring less than 24 hours after admission to the ICU.

CONCLUSION: ICU medicine in Ghana is relatively new with few beds dedicated to critically ill patients. There are challenges with human resource, equipments, medications, and consumables needed for critical care. Compared to the developed world patients admitted to our ICU are relatively young and they fall in the category of poly trauma or post operative cases. The average length of stay is short with a high mortality. 25% of the mortalities occurred less than 24 hours after admission to the ICU.
NIV (NON-INVASIVE VENTILATION) IN RESPIRATORY FAILURE – OUR EXPERIENCE IN BANGLADESH

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Square Hospital LTD, Bangladesh

NIV is a method of ventilatory support which is delivered to the patient without using an invasive airway. For the last two decades it is increasingly used as an accepted method of mechanical ventilatory support as it is proved to have many positive outcomes as it can prevent invasive ventilation & its complication. In a tertiary care hospital of Bangladesh we are using this method in all patients meeting the NIV criteria & not having absolute contraindication irrespective of diagnosis. Our study aimed to access the outcome of the NIV trial using our local resource & to compare it with others. This is an ongoing prospective study and till this report data from 82 patients were analyzed here of which 50% patient ended with positive outcome & 50% ended as negative outcome. As the result of this method varies significantly by diagnosis & severity of disease we are generating specific recommendations for the likely outcome according to the diagnosis.
The RELATIONSHIP OF PREMATURE MORTALITY RATE AND ACCESSIBILITY, QUALITY OF CRITICAL MEDICINE IN MONGOLIA

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**Background:** The goal of critical care services is to prevent premature death by providing the advanced intensive treatment of reversible illnesses. Effective critical care support is associated with reduced premature mortality, has enormous potential to improve population health outcomes. The premature mortality rates indicate the accessibility and quality of critical care. The patients who require critical care in the LMICs (including severe pneumonia, acute gastrointestinal infection, diarrhea, road traffic injuries, obstetric complications and surgical emergencies), occurs more common than in the HICs.

**Goal:** To determine the basic capacity and infrastructure of critical care in district hospitals of Mongolia and to identify the main causes of the in-hospital premature mortality in selected hospitals.

**Methods:** This mixed method study consists of three study and was conducted in 9 randomly selected district (i.e. provincial) hospitals. While (1) a cross-sectional observation study assessed the accessibility, infrastructures and quality of critical care using predefined questionnaire, (2) the in-hospital mortality and its cause were determined by retrospective analysis of case notes of last 6 months. Additionally, (3) emergency care knowledge of 55 primary care doctors, who refer patients to the surveyed hospitals, was assessed using standardized Vital-Sign-Directed-Therapy test.

**Results:** Surveyed hospitals had on an average 246 beds of which 2.03% used for ICU. There were 3 (2-7) ICU doctors per hospital and the nurse-to-patient ratio was 1 to 4. Only 1/3 of study hospitals had a constant oxygen supply and 24/7 ICU doctor on-call coverage. The ICU beds with ventilators were 3.3 per 100,000 populations.

In the last 6 months, 119 fatal cases, including 2 maternal deaths, were registered in surveyed hospitals. Fatal cases average age was 50.2 years, 67.2% of them were treated in the ICU and 53% were stayed shorter than 24 hours in the ICU. The main causes for mortality were unconscious states 41.2%, emergency surgery 21%, cardiovascular failure 12.6%, respiratory failure 8.4%, elective surgery 1.7% and others 15.1%. The co-morbidity was registered as non-fatal co-morbidity diseases 50.4%, ultimately fatal diseases 20.2%, rapidly fatal diseases 5.0% by McCabe classification.

The 24.4% of the cases were ventilated in ICU, 26.9% used vasopressors and inotropes to treat the shock conditions and 43.7% of the fatal cases confirmed clinical diagnoses by autopsy.

The Vital-Signs-Directed Therapy test results showed that the emergency care knowledge of 55 rural primary care doctors were fairly good in determining the GCS (85.5%) and shock states (90%) in contrast to determining BLS algorithm (60%) and initial emergency care in acute bleeding (43.6%).

**Conclusions:** There is a severe shortage of standardized ICU beds and qualified ICU doctors and nurses in peripheral hospitals of Mongolia. Due to a poor critical care services, the unconscious states and emergency surgery complications are remained as the main causes of in-hospital mortality. Outdated technologies and lack of knowledge and skills in critical care technologies add more risks to that.
Snake bite is one of the public health issues in rural communities living in tropical country. South East Asia and South Asia areas are heavily affected area due to widespread agricultural activities, density of population and presence of numerous snake species. According to toxicity it can be divided into haematotoxic, neurotoxicity and myotoxic. In Myanmar, scale of mortality and acute or chronic morbidity due to snake bite remains uncertain because of inadequate reporting. In 1991, there were 14000 bites with 1000 deaths and in 1997, 8000 bites with 500 deaths. The average case fatality is 7.9%. In some townships case fatality is still between 10%-40%. 90% of bites are caused by Russells vipers (Daboia stamensis). In among the different kinds of snake bite, life of neurotoxic snake bite patients can be saved by timely treatment with anti snake venom when systemic envenomation signs are seen; ptosis, ophthalmoplegia, limb weakness, palatal weakness and respiratory difficulty. Rational use of ASV can substantially reduce mortality and morbidity due to snake bites. Antivenom treatment alone is not sufficient to save the life of patient with bulbar and respiratory paralysis and these patients may require mechanical ventilatory support for some hours and they usually recovered completely. But in certain patient neuromuscular weakness is persisted for days despite anti snake venom treatment and ventilatory support. Improvement of neuromuscular weakness is seen in such patient when anticholinesterase drug such as endrophonium or nesting mine is given. These drugs can partly overcome blockade by post synaptic neurotoxin and have shown efficacy in cobra bite management. In area where transport to tertiary hospital for respiratory support is difficult, trial of anticholinesterase should be performed in neurotoxin envenoming. Patients who respond can be maintained on neostigmine methyl sulphate. In conclusion the successful management of snake bite depends on many factors; health education to public and health workers, availability of ASV of appropriate specificity and use of adequate dosage, presence of national guidelines based on evidence based data.
CRITICAL CARE IN MY COUNTRY: THE CURRENT STATUS AND FUTURE ISSUES

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Caja Nacional de Salud, Bolivia
CRITICAL CARE WITHOUT WALLS OF INDONESIA

Tri Wahyu Murmi

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Nowadays, there are increasing numbers of critically ill patients with serious problem or complication that may result in death, because a limited ICU bed lead of rejection of ICU admission. In many hospital in Indonesia its not easy and expensive to set up more bed space of ICU with the equipment to support critically ill patients and the other problem lack of trained nursing staff / trained critical care medical specialist. Adverse outcomes due to delayed resuscitation one of the most important aims to changing role of hospitals.

The concept, moving outside of the walls of the intensive care unit suggests an option to improved hospital outcomes. Mortality rate higher in ICU for patient delayed recognition and management or delayed resuscitation or heart attack from outside of hospital or revered from general wards, more of that its preventable cases. The other problem is lack of transportation and untrained of critical care nurse/ physician, caused patient die without resuscitation.

How to begin to think and act outside for all critical care professional not only waiting patient at risk with irreversible organ disfunction delivered to them inside four walls.Its important to have special training to avoid unnecessary delayeds in treatment with pottentially life threatening and prevent of organ dysfunction. The implementation should be with create the guided rule or strategies, create the team and the urgent care code in hospital, continues training for hospital healthcare staff outside the ICU and the nurses. Training for healthcare providers of critical care in Indonesia begin in 2000 without focused, after 2010 Ministry of Health decide to improve training for primary health-care especially at an isolated area/ island outside of hospital. Improve the skill of nurses or physician in Hospital (ED). Innovation the management procedures (early detection, early resuscitation/ early intervention) its key role with multidiciplinary approach with rapid response team to prevent critical patient refered to ICU as a new service of critical care without wall.
HOW WE MANAGE TRAUMATIC HEAD INJURIES IN LOW RESOURCES - RURAL KENYA (EAST AFRICA)

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DEFINITION: Any severe trauma to the head in which the patient sustains any degree of loss of consciousness. The victim may not be aware of the event but passers-by/ or witnesses are allowed to give the medical history.

INCIDENCE: By far, the commonest causes are; motor-cycle (“Boda-boda”) related Road Traffic Accidents, followed by assault with blunt objects and thirdly, falls from heights (especially in children).

SETTING: Rural Kenya (East Africa)

MANAGEMENT: Specific wards have been set aside for these patients in most Rural (County) Hospitals. Since the nursing ratios cannot allow for one-to-one care, and there being no ICU equipment for monitoring the patients’ vital signs, the patients’ next-of-kin are allowed to stay at the bed-side throughout the patient’s stay in the ward. On admission and initial stabilization, this consists of: Oxygen via simple face mask, institution of an Intra Venous line and administration of Normal Saline, urethral catheterization and passage of a nasal/ oral -gastric feeding tube - a Plain two view Skull X-ray is performed. The available nurse will check on the patient’s Pulse rate, Blood Pressure, Respiratory rate and Pattern and Pupillary response/size, once in a while and whenever summoned by the relative. The resident junior medical doctors are trained to diagnose depressed skull fractures from these films alone, and are able to conduct surgical toilet and elevation of the same under Halothane anaesthesia with Endo-Tracheal Tube. The anaesthesiologists are almost always trained “Clinical Officers” or Nurses, the equivalent of Nurse Anaesthetists in the USA/UK. At Craniotomy, the surgeon will make an on-the-table decision as to whether to open the Dura or not, depending on its colour and the pressure from underlying structures, as can be felt with his palpating finger. A dark colour often signifies collected blood (Sub-Dural Haematoma), while increased pressure signifies a raised Intra-Cranial Pressure.

If facilities allow, the patient is nursed in the same hospital post operatively. Broad spectrum antibiotics, (Crystalline Penicillin plus/ minus Gentamycin) are given prophylactically. For analgesia, the patients receive either I.V. Tramadol or Paracetamol tablets, which are crushed and passed through the feeding tube with tap water. Relatives are encouraged to bring food from home which is then blended into a soft liquid paste and is fed to the patient through the feeding tube.

If the anaesthetist is dissatisfied about the patient’s post-operative condition, attempts are made to transfer the patient to a higher level hospital for further management. Transfer is always by road ambulance and with an accompanying clinician and relative.

CONCLUSION: Morbidity and mortality are very high, given the circumstances under which many clinicians work and the severity of the injuries encountered. Most deaths are as a result of adult passengers on motor bikes who were riding without wearing safety helmets, assaults with wooden clubs during robberies, and falls from heights above 10 feet (children) and 20 feet (adults).
ULTRASOUND VS LANDMARK TECHNIQUE TO CANNULATE INTERNAL JUGULAR VEIN IN ICU AT KATHMANDU MEDICAL COLLEGE HOSPITAL – A COMPARATIVE STUDY

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Background/Purpose: Find out if an ultrasound technique has advantages over the conventional landmark technique during central venous cannulation in patients admitted in intensive care unit.

Methods: Prospective randomized comparative study on 120 patients requiring central venous cannulation in intensive care.

Results: The number of attempts was 1.5 (1 - 3) and 2 (1 - 3) in the ultrasound and landmark group respectively (p = 0.001). The first attempt success rate was 39/60 (63 %) in the ultrasound group and 19/60 (32 %) with the landmark technique. The seven (12 %) failure cases in the landmark group were rescued by the ultrasound technique. Inadvertent carotid artery puncture occurred in 2/60 (3 %) and 6/60 (10 %) of patients in the ultrasound and landmark group respectively.

Conclusions: Ultrasound improves success rate and reduces complications during internal jugular vein cannulation. It can be employed as a rescue technique in cases of a failed landmark technique in Intensive care setup.
EVOLUTION OF CRITICAL CARE IN PAKISTAN IN THE LAST THREE DECADES

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In a developing country like Pakistan where health budget is 2.5% of National Budget it has taken decades to develop the costly facilities of critical care for the very sick patients. The evolution in last three decades had been on a faster pace than earlier decades. The burden of diseases has increased tremendously in three dimension.

1. Diseases & Pathology, still rampant in this part of the world, e.g tetanus, Eclampsia ruptured uterus, obstetric fistulas (V.V.F & R.V.F) complicated Tuberculosis.

Increasing incidence of sepsis due to lack of facility and poverty.

2. Trend of organ transplant programs, leading to increasing no. of kidney and liver transplants. 1985 saw the first kidney transplant in a public sector hospital and now three decades later it is a routine along with liver transplantation at 2-3 centres.

3. Increasing number of trauma injuries due to weapons of mass destruction (bomb blast & burn injuries) resulting in poly trauma and in need of intensive care managements.

Health care in Pakistan is provided by three mechanisms:
- Public sector hospitals which is free.
- Charitable hospitals managed by NGOs provide subsidized OR free service.
- Private hospitals provide it at a cost.

Management of these increasing burden of diseases in critical care units has gone through a sea of change in the last ten years in terms of physical facilities, equipments, drugs, management protocol and different tiers of manpower.

There were two Tertiary care hospitals at the time of birth of Pakistan in 1947. No concept of intensive care unit was there. Next 25-30 years saw growth of intensive care units, in big hospitals all over the country. Coronary care units also developed under the same umbrella of I.C.U with invasive & non-invasive tools.

Decade 85-95
- Unidisciplinary & Multidisciplinary I.C.U
- Invasive & non-invasive monitoring.
- I.C.U support for postoperative patients needing system support.
- Lack of adequate premises with controlled environment.
- Shortage of trained staff & specialist.

Decade 1995-2005
- Increase in number of intensive care units.
- More sophisticated ventilation and monitors.
- Better infection control.
- Better environment control.
- Better trained work force.
- More efficient medicines.

Decade 2005-2015
- Better understanding of Pathophysiology.
- Adoption of evidence based medicine.
- Shortage of trained I.C.U man power.
- Adoption of international guide lines.
- Efficient equipments & tools.
- Confidence building of all health care providers.

Presently we have well developed critical care units in majority of tertiary care and in public sector and private sector. We are providing critical care support to all kinds of state of art surgery and medical ailments. Advanced neglected pathology due to poverty, negligence & ignorance is managed with better results. Obviously different level of standard of care is provided in the three system of health care provision.

Private sector hospitals and well funded NGO charitable hospitals are providing highest standard of critical care managements.
LIMITATIONS IN MONITORING THE PATIENT WITH HEAD TRAUMA IN EL SALVADOR

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El Salvador is a country in Central America. The current population is 5,744,113 inhabitants, with an average of 3.8 members per family and with a monthly economic income of approximately $506.91 per month. In addition, the population density is 301 people per square kilometer, the most densely populated country of America. The health system of El Salvador has 6 large structures that give support to primary, secondary and tertiary care, distributed at the National Ministry of Health (MINSAL), private health services, the Salvadoran Social Security Institute, Bienestar Magisterial and Armed Forces Care. The National Ministry of Health has 30 hospitals with a total of 1.1 beds per 1,000 population and 0.7 ICU beds per 100,000 population, which clearly shows the precariousness of the hospital system in El Salvador. In 2012 MINSAL reported 1,004,788 registered emergencies. Among the 10 leading causes of hospital care are described arterial hypertension, diabetes mellitus and multiple trauma. Of diseases related to hospital mortality, 51.9% were due to chronic diseases such as acute myocardial infarction and end-stage renal failure, diabetes mellitus and non-insulin, unspecified gastrointestinal bleeding. 32.9% were due to infectious causes include pneumonia, septic shock and Disease Human Immunodeficiency Virus [HIV], 15.2% and intracranial injuries and multiple trauma injuries requiring surgical care. Every year, El Salvador, recorded an increase in cases of polytrauma due to traffic accidents, work or social violence. Despite this scenario, higher-level hospitals rarely tend to use Neuromonitoring systems, this being a debt with patients sometime require. In addition, there is no official statistical source that describes the current state of neuromonitoring in El Salvador. Despite institutional efforts, most hospitals do not have any system of monitoring or intracranial brain function and those who have it, do not use it properly. In this report, an analysis of the current situation in our country Neuromonitoring ago, the limitations that prevent proper use of this technology and future expectations of these techniques in the management of patients with a brain pathology.
HIGH MORTALITY FROM BLOOD STREAM INFECTION IN ADDIS ABABA, ETHIOPIA, IS DUE TO ANTIMICROBIAL RESISTANCE: AN OBSERVATIONAL COHORT STUDY

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Background: We studied the importance of bacterial patterns and prevailing antimicrobial resistance in the outcome of blood stream infections (BSI) at Addis Ababa, Ethiopia.

Methods: Clinical and laboratory characteristics of sepsis in 299 adult patients with two or more SIRS criteria were studied at Black Lion Hospital (BLH), Addis Ababa, Ethiopia. Charlson comorbidity index scores were calculated. Distribution of bacterial species including their resistance pattern was studied from 166 pediatric blood culture isolates in the same hospital from cases of early/late neonatal septicemia and older children with sepsis.

Results: Risk of death increased four folds when blood culture result was positive (44.7% vs. 10.3%, X² = 33.0, p < 0.0005). For patients with sepsis from Gram Negative Bacteria (GNB), survival depended on in vitro sensitivity towards third generation cephalosporins (8/10 vs. 1/10, X² = 7.27, p = 0.007). In the pediatric group, ceftazidime resistance was recorded in 64 (70%) of the 92 isolates. Co-resistance towards gentamicin, chloramphenicol, tetracycline and co-trimoxazole was recorded in ≥71% of ceftazidime resistant isolates. Ceftazidime-resistant GNB isolates were identified at both hospitals.

Conclusion: Proven sepsis, i.e. bacteremia in patients with two or more SIRS criteria has high mortality. Survival depends on antimicrobial sensitivity. Concomitant resistance towards third generation cephalosporins, gentamicin, chloramphenicol, tetracycline and co-trimoxazole were the rule not for one, but for all GNB species in this study. Multi-resistant GNB is either nosocomial problem shared between the two hospitals, or a community-wide problem at Addis Ababa.
CHALLENGES AND THE WAY FORWARD IN THE PICU

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90% of critical illness and pediatric mortality worldwide is located in resource-poor settings. The highest rates of child mortality are still in sub-Saharan Africa where 1 in 9 children dies before the age of five years. The majority of pediatric mortality is related to preventable and treatable illnesses. Pediatric Critical Care faces similar challenges as other aspects of medicine in the developing countries, with the largest global population of children suffering from the greatest burden of life threatening diseases and concurrent illnesses, making diseases more complex and resulting in high mortality rates. The wide disease spectrum, limited availability of resources and high costs of therapy and care have added on to the poor outcome. Deaths are mainly from neurological and respiratory illnesses, diarrhea, malaria and prematurity. Delayed presentation to a health care facility, delayed triage and emergency care leads to high mortality. Many children in developing countries lack access to resources in the chain of survival: emergency transport services, trauma teams, diagnostic and monitoring equipment, critical care, and rehabilitation resources. Guidelines for treatment in high-income countries therefore have limited applicability in less-resourced countries. Shortage of staff leading to overburdening of the working staff remains an important limitation in inpatient monitoring and reassessment, the very essential aspects of effective and timely management of a critically-ill child.

Currently, available simple interventions are being implemented in the hope of large gains. Maternal participation in inpatient monitoring is being increasingly utilized. Widespread training of medical and paramedical staff and students on fundamentals of critical care, emergency triage and assessment are improving early recognition and transfer of very sick children to health care facilities. A significant need for Pediatric emergency and critical care training programme has been realized to serve Central, West and East African region and provide expertise that goes beyond the training and skills of general pediatricians, in collaboration with local and worldwide experts.
CRITICAL CARE MEDICINE IN LOW RESOURCE COUNTRIES: OBSTACLES AND OPPORTUNITIES

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Critical Care Medicine has already reached to extracorporeal life supports and organ transplants in developed ICUs. However, there are many resource-limited settings where critical care is still in primitive stages fighting infections and resources. Among them, Nepal is one with 30 million populations and with only around 500 ICU beds.

The first obstacle is the absence of trained manpower, and is one of the greatest leading to delay in development of CCM in Nepal. But now, since last two years, the training of Intensivists has started. Similarly, trained Nurses are clearly in short along with allied staffs like physiotherapist, infection control, nutritionists etc.

There is also a huge burden to the patient family as the health care is private and there is no universal coverage or insurance and people have to pay from their own. Patients and families resort to selling their land and other properties to treat their loved one in ICUs. This also leads to many patients being withdrawn at a earlier stages than what should happen. There are certain government funds that take care of these patients but they do not provide supplies and higher antibiotics, but only cover certain service and laboratory expenses.

Till now the focus in Low resources country has been on ACCESS and not on QUALITY. And thus there is a lack of knowledge about patient safety and quality and there is no governing body, and thus no one is responsible to supervise. The story is same for Infection control also.

Another area is the need for documentations; data collections as there is no registry and nobody knows how many ICU beds are there in the country, what are the levels of these ICUs, etc. There is clearly a need for ICU Registry and development of EMRs for Hospitals.

Other challenges include the unavailability of Electricity, Fuel backup for Generators, Oxygen etc.

On top of these existing challenges, the earthquake in April/May 2015 has shaken the economy and similarly the healthcare of the country and will take many years to build up.

Although the resources are limited, that has also given many opportunities for us to work and serve. There is a huge area of collaboration where international community are collaborating and can further help in these countries to develop and improve critical care. These can be in training manpower at various levels, creating the database and ICU registry, or directly into patient care.
DISEASE LOAD OF CRITICAL CARE IN PAKISTAN

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Critical Care concept and management has been there for more than three decades in Pakistan, however it is still in its infancy. The spectrum of critical care set ups vary from a few sophisticated, very well equipped and adequately staffed state of the art units to those ICUs that have very basic facilities. Reasons are many. Resource constraints, paucity of qualified and trained personnel, and above all lack of political will and government policies. This is revealed in the WHO statistics which reports that Pakistan’s total health expenditure as a percentage of GDP is 2.7 only (WHO-2013).

With abundance of advanced disease, deadly infections and extremely complicated obstetrics due to lack of antenatal care; good critical care services, where available make a major difference in the patient outcome. If we analyse yearly data of a public sector Surgical ICU Civil Hospital Karachi, the case mix seen are unknown to the physician of the developed countries. Pathologies like tetanus, typhoid perforations, tuberculous abdomen and faecal peritonitis from these pathologies and trauma are in abundance. Complicated obstetrics make the hallmark of all surgical ICUs. Females with severe eclampsia, massive haemorrhage from abruptio placenta, uterine rupture and puerperal sepsis resulting from home deliveries done by untrained midwives (Dai) coming after days of the procedure are some of the challenges faced by the intensivist of this region. WHO statistics rate Maternal mortality ratio as 260 per 100,000 live births. Delays in recognition, long travel distances due to lack of medical facilities even in peripheral areas of big cities, inability to pay, lack of coordination, all add up to prevent the extension of timely care for preventable life threatening conditions.

Superimposed on this is the dilemma of non-availability in most critical care units, of, point of care testing, invasive monitoring and other sophisticated equipment considered essential for managing the seriously ill in the developed countries. Prohibitive costs of drugs and disposables, are also a challenge faced by the treating physician. With the present situation of law and order in the country and better remunerations in the Middle East there is a constant trend of medical doctors to emigrate and a number of qualified and trained are leaving the land for greener pastures. Limited bed strength, over populated cities and lateral pressures are also major hindrances to patient management.

However, it has been seen that with all these limitations, timely delivery of simple interventions greatly reduces morbidity and mortality. Early recognition and safe transportation are essential. Good clinical decision making supported by rational implementable protocols and guidelines, simple investigations, vigilant basic monitoring and systemic support, if provided to these very sick patients reduces morbidity and mortality significantly.

Pakistan society of critical care medicine recently took the initiative of developing guidelines for the management of sepsis keeping the limitations in view. Better use of existing resources and focusing on local adaptations seem to be the only way forward in making a major difference to the outcome of the critically ill in the resource constrained countries.
ICU PROTOCOLS: THE PHILIPPINE HEART CENTER INITIATIVE

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Monitoring and management of critically-ill patients have always been a challenging task for intensivists. Protocols, which standardize care and regulates management of patients with similar diseases, provide a potential and promising answer to managing multiple problems of critically-ill patients. Through the years, the Philippine Heart Center has been adherent to international guidelines with regard to basic ICU care. Realizing the inherent and increasing complexities of disease complications, the intensivist group in our institution initiated the formation of ICU Protocols that hope to improve quality of care for both medical and surgical intensive care patients.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN ETHIOPIA

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Introduction: Ethiopia is a sub-Saharan African country located at the north east of the continent. It is second most populous country in Africa with a population of slightly over 90 millions. It is an emerging economy where health care indices have showed marked improvement recently. In Ethiopian hospitals Critical care service is not well developed but currently there are important initiatives in this area which are described here.

Methodology: Documents related to critical care units development and implementation from different government and nongovernmental data sources are used as a resource for this article design.

Results: In Ethiopia, the first critical care units were established in Tikur Anbessa Specialized Hospital (TASH) as medical ICU and Surgical ICU two decades ago. Nevertheless, the service has not been expanded to the bigger parts of the country where regional hospitals are located. Currently there are about 10 hospitals with functional critical units in the public health care system, though the units are smaller ranging from 6-10 beds capacity.

Federal Ministry Of Health (FMOH) has recently considered the problems to equity, access and quality care related to emergency and critical care services. Hence, it has established emergency services development unit under which there critical care team which has devised a road map for future development. The Ministry has selected about 20 public hospitals from Addis Ababa and the regional hospitals in order to establish and develop critical care service. Furthermore, short and long term training of human resources, delivery of essential equipment and supplies, allocation of budget and monitoring of these efforts is moving forward through collaboration of different stakeholders.

In addition, higher level human resource training is being conducted by Addis Ababa University (AAU). Currently, the university is running the following critical care training for physicians: Anesthesiology, Pulmonary Critical Care, Emergency and Critical Care Medicine, Pediatrics Emergency and Critical Care Medicine. Besides, independent critical care fellowship curriculum is under development, which will accept trainee from different clinical specialities. AAU also have nursing masters program in Emergency and critical care and a new program has also been started for nurses in different universities to upgrade diploma nurses to emergency and critical specialty nursing at BSC level. All these programs are relatively new and currently there are only few graduates in the field.

Discussion and Recommendation: The current efforts to develop critical care by the ministry and universities is commendable. These needs greater in country collaboration to develop and sustain the newly established units. There are also important areas to address like establishment society, better international and private sector collaboration, biomedical service development and training of all mix of critical care human resource. In addition to the training it is important to retain professionals so that they serve in the labor intensive area for longer time. Leadership is also key for development of such a key service as it is in infancy level. Hence, committed leaders who will champion the development critical acre in Ethiopia should come to the surface handle this issue.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN MY COUNTRY

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Critical care medicine is a branch of medicine concerned with the diagnosis and management of life-threatening conditions requiring sophisticated organ support and invasive monitoring. Modern critical care medicine emerged in the 1950s, largely pioneered by the anesthetist during the polio epidemic in 1953. Nigeria is the most populous country in Africa and the seventh most populous country in the world with a population of approximately 174 million inhabitants. The first intensive care unit (ICU) in Nigeria was however established in 1973, following the successful management of cardiac surgery patients during the oil boom era staffed largely by expatriates and overseas-trained Nigerian. Subsequently, other Federal Universities Teaching Hospitals/Tertiary Care centers developed their own ICUs within the country. Private ICUs have also been established in the big cities in the last two decades.

More than four decades after setting up of the first ICU in Nigeria, the evolution and growth of critical care medicine has been hampered by challenges of economic reversal resulting in low wages, frequent healthcare workers trade dispute/unrest, manpower flight overseas, poor electricity/water supply, government apathy towards funding of hospital, poor hospital administration and endemic corruption.

Emerging trend from the newly elected democratic government in the country with a focus of fighting endemic corruption and clampdown on resources diversion as well as improved political will to invest more fund into healthcare financing at the Tertiary level offer prospect of hope for the stunted growth of the subspecialty. This will lead to reasonably high standard of critical care medicine rebirth as well as its sustainability in Nigeria.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN OUR COUNTRY/HOW TO MANAGE THE ICU IN THE PHILIPPINES

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Heart Failure Society of the Philippines, Philippines

The Critical Care Unit are specially designed facility staffed with skilled personnel providing effective and safe care for patients with life threatening conditions aim at providing optimal care to improve several of the acute and critically treated patients.

During the time of Florence Nightingale in 1850 she created a care area for wounded soldiers and recommended a special post-surgical area for theme. In 1959, the first modern critical care units with advanced monitoring was created at UCLA under Dr. Max Harry Weil and Herbert Shubin. By 1997, more than 5,000 ICUs are in operation across the US and today that have 6,000 Critical Care Facilities subdivide into NICU, MICU, SICU, PICU, CCU and Burn Units.

The Evolution of Critical Care Medicine started in 1978-79 with the Western Pacific Associated of Critical Care Medicine was co-founded by Dr. Quintin Gomez, Dr. Ono and Dr. Fugiwara. It was in 1987, that the idea of organizing the Philippine Group was diverse in Hong Kong.

In 1998, the first formal training of Pediatric Critical Care was started by Dr. Herminia Cifra in Lungsod ng Kabataan-Philippine Childrens Medical Center (PCMC) and UP-PGH.

In 1992, the Philippine Society of Critical Care Medicine was officially founded. In 1992, it was registered with the Security and Exchange Commission. By 1999, hosted the 10th International Congress of Critical Care at the Philippine International Convention Center. By 2000, the first section of Critical Care Medicine at the Philippine Heart Center was founded by the late Dr. Santos Jose Abad.

At the Philippine Heart Center, one third (1/3) of the hospital 378 bed capacity designated as CCU, MICU, SICU, PICU and Neuro ICU.
EXPERIENCE IN TREATMENT FOR SEVERE ACUTE PANCREATITIS

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Effectiveness of continues veno-venous hemofiltration (CVVH) and drainage necrosis fluid under ECHO or CT guide on treatment of severe acute pancreatitis (SAP) in intensive care unit of Bach Mai Hospital;

Retrospective study conducted in 85 severe acute pancreatitis patients in ICU of Bach Mai Hospital (APACHE II score is 13±3.85): A total of 85 SAP patients were treated with conventional protocol combined with CVVH and drained necrosis fluid under ECHO or CT guide. HVHF was started 35 ± 25.5 hours after onset of the disease, AN69 hemofilter was changed every 12-24 hours. The ultrafiltration rate during HVHF was 45ml /kg, blood flow rate was 200-250 ml/min and the substitute fluid was infused with 50% pre-dilution. Low molecular weight heparin was used for anticoagulation.

CVVH was well tolerated in all patients; 65 patients were drained percutaneously following initial diagnosis with computed tomography or ECHO and fine-needle aspiration. The vital signs, laboratory parameters and intra-abdominal pressure of all the patients were improved following the time. The Sofa score decreased after 3 days. The mortality rate is 13.6% and 22.2% in very severe patients group. 52/65 (80%) patients were cured completely without surgery. 13/65 (20%) patients required some type of surgery despite successful treatment of the fluid collection. Complications occurred in 6 (9.2%) patients, but only two complications (3%), empyema, was a direct result of catheter drainage.

CVVH and drainage of necrosis fluid under ECHO or CT guide are good methods for treatment of severe acute pancreatitis. This study confirms that necrosis pancreatic fluid collections can be safely and effectively treated with percutaneous catheter techniques in most patients. CVVH is technically possible in SAP patients and expected to become beneficial adjunct therapy for SAP.
CURRENT STATUS OF NON INVASIVE MECHANICAL VENTILATION IN NICARAGUA

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CRITICAL CARE IN EL SALVADOR: NEW CHALLENGES

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Background: El Salvador (ES) is a small country in Latin America. It has 6.3 million inhabitants (60% in urban areas) and 2.5 million more spread around the world, principally USA. It is considered by the World Bank as a lower middle income economy. Its gross national income per capita is US$ 7,490, and its health expenditure per capita is US$ 266.

Purpose: To show current and future challenges of Intensive Care in El Salvador.

Method: Revision of country statistical and local intensive care units (ICUs) information.

Results: ES has a fragmented health system, public system covers 81% of population; The Salvadoran Social Security (workers system), 17%; and private and other systems, 1%. The first Critical Care Unit was established in 1979. ASALMECCI (Salvadoran Critical Care Association) was founded in 1987. The overall rate of ICU bed is 2 per 100,000 inhabitants; public health adult ICU rate is 2.3 per 100,000 inhabitants; social security adult ICU rate is 4.8 per 100,000 inhabitants. The ratio intensivist/inhabitants is 0.6 per 100,000.

There are intensivists formed in local and foreigner programs, but the specialty is not attractive for young physicians because required a spent of time and effort, and by low income. Same scenario is seen with allied professionals.

Intensive Care Units in ES have very limited resources in public and worker health systems, which are solved gradually. To emphasize, the Salvadoran Critical Care Association, in conjunction with COCECATI, is developing more academic and scientific activities for professionals in the care of critically ill patient.

Conclusion: Critical Care in El Salvador is a relatively new specialty with a lot of challenges for the professionals in this field.
CRITICAL CARE IN TANZANIA

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**Background:** Tanzania in East Africa has a population of 44.9 million.

**Methods:** Literature review and personal observation of hospitals in keeping with critical care

**Results:** Tanzania has 20 Anaesthesiologists. Most intensive care is carried out by nurses, or by partially trained Anaesthetic Officers, whose knowledge and skills are largely gained during their initial vocational training and in other cases through various exchange programs. While basic health services are provided from domiciles, and facilicities close by i.e dispensaries, health centres. Hospitals (District, Regional, Zonal, National) only have critical care units modern ICUs are few and sparsely distributed. Very few have appropriate equipment.

Radiological, Laboratory services exist, but Mechanical Ventilation is available in facilities with Anaesthesiologists/Intensivists (the existence of certain equipment in a hospital does not mean it is in working order or in the correct place, used for correct patients and at correct time). Few have Physiotherapy services, none has respiratory therapists. Many of the structures necessary for Critical Care are lacking in Tanzania.

Reasons stem from the fact that critical care has not been prioritized politically or medically, few intensive care specialists, belief that Critical Care requires sophisticated or expensive equipment, fatalism among staff with low morale and self fulfilling, the lack of guidelines implies that standardized and evidence based care is not being followed, improving the service could lead to decreasing mortalities, challenging fatalism in the process. Vertical programs, while successfully at tackling diseases, have been less successful at strengthening health systems.

The importance of good quality anaesthesia and intensive care is increasingly being understood, providing care for very sick patients has the potential of reducing preventable mortality, intensive care has a vital role in many aspects of hospital services.

Without good and quality intensive care, missing early and timely recognition of very sick patients, maternal mortality following obstetric complications will not be reduced, neonatal deaths from asphyxia and sepsis will continue, case fatality rates: cerebral malaria, severe pneumonia and severe diarrhea will stay high deaths due to traffic accidents will remain common.

While there is a need for good quality care for patients with serious illness in all countries of the world, Emergency and Critical Care tend to be one of the weakest parts of health systems in low-income countries.
Data on critical care capacity, considering access to both physical resources and health care professionals, are essential for health system planning but generally lacking or difficult to find. Efforts are being enlisted by the Government to reverse the situation albeit at a slow pace.

Particular weaknesses are seen in infrastructure, routines and manpower training, whereas the availability of drugs and equipment is generally good. Policies development to improve hospital systems for the care of emergency and critically ill patients should be prioritized.

**Conclusion:** SATA is at the fore front in ensuring that necessary manpower is developed, recruited and retained in all facilities with staff, space and equipment for care of the critically ill.
INTENSIVE CARE MANAGEMENT OF SUBARACHNOID HAEMORRHAGE

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Subarachnoid Haemorrhage that accounts for five percent of all strokes is a common clinical condition seen in critically ill patients in the Intensive Care Unit. Fifteen per cent of patients die even before admission to hospital. The common causes are rupture of a cerebral aneurysm, rupture of an AVM, and traumatic brain injury. Of the above causes the commonest is the rupture of a cerebral aneurysms, which are congenital. This is associated with connective tissue disorders, renal conditions and essential hypertension. The commonest presentation is a severe headache prior to the patient losing consciousness. Unconsciousness may continue if the intra-cranial pressure continues to remain elevated. In addition they may have focal neurological deficits as well as seizures. On admission to the ICU the severity of the Subarachnoid Haemorrhage is assessed by the Hunt and Hess scoring or the WFNS grading. The extent of the Subarachnoid Haemorrhage on the CT scan is graded according to the Fischer grading. Our main aim in the management of these patients is to prevent a re-bleed that increases the mortality to thirty per cent in the first twenty-four hours. The survivors have a high morbidity with functional disabilities and cognitive dysfunction. Primary brain damage occurs due to rise in intracranial pressure, reduction in cerebral perfusion pressure, and cerebral vasospasm. There can be secondary damage due to ICH. We need to look out for the complications and prevent them and at the same time go for definitive care of the aneurysm by isolating surgically or radiologically by coiling.

The complications that we have to be on the look out for are cerebral ischaemia, which may lead to infarction, raised ICP, hydrocephalus, neurogenic pulmonary oedema and Na imbalance. Delayed cerebral ischaemia has been identified as one of the commonest and dreaded complications. If it can be reduced by early identification of at risk patients the outcome can be improved dramatically in patients who survive to be admitted to the ICU.
HOW TO MANAGE AN ICU IN A COUNTRY WITH FEWER MEDICAL RESOURCES: EXPERIENCE FROM VIETNAM

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Vietnam is the underdeveloped country with GDP was below $100 in early 1990s and approximately $1,000 in 2010. Although facing with many challenges, the Critical Care system in Vietnam has been improving and operating effectively due to appropriate strategies:

Determine and train fundamental emergency and critical care techniques and procedures (airway control, cardiopulmonary resuscitation, essential hemostatic techniques, fixing fractured bone, quick intravenous access) to all physicians and nurses. It is the first and most important step.

Update medical knowledge, exchange experience with colleagues from developed countries. Practice evidence based medicine in diagnosis and treatment in order to decrease the mortality.

Establish protocols based on international guidelines and the practical condition in Vietnam such as: airway control, mechanical ventilation strategy, early fluid resuscitation, anaphylactic shock management, peritoneal dialysis with common intravenous fluid.

Apply the new, advanced organ-supports methods in critical care field (IHD, CVVH, PEX. MARS, ECMO) for critically-ill patients with reasonable cost.

Teamwork.

Achievements:

Decreased mortality.

Performing most of the advanced and complex critical care techniques.

Challenges:

Overloaded ICU, stressful specialty, lack of manpower (both physicians and nurses).

High nosocomial infection rate.
SITUATIONAL ANALYSIS OF CRITICAL CARE IN LEÓN, NICARAGUA

Luis Manuel PADILLA

Ministerio de salud heodra
CRITICAL CARE FOR CHILDREN: WHAT CAN BE ACHIEVED IN LOW RESOURCE SETTINGS

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Background: Hospital based child and neonatal critical care has received little attention in the global health agenda. Malawi improved its paediatric critical care services through implementation of packages such as standard case management of pneumonia, Emergency Triage Assessment and Treatment (ETAT), paediatric care audits and bubble Continuous Positive Airway Pressure (bCPAP) in first referral hospitals where majority of severely ill children are managed. Often sick children are inadequately recognized and stabilized by health workers because they have limited paediatric training and functioning equipment are not always available.

Objective: To describe the impact of implementing critical care interventions in reducing child and neonatal mortality and the risk factors for high child and neonatal mortality in Malawian hospitals.

Methods: In year 2000, health workers practising critical paediatric care in 41 hospitals were trained in a step-wise approach in standard case management of pneumonia based on the World Health Organisation guidelines. In 2008, the Ministry added the ETAT package to improve paediatric critical care. Health workers were trained in ETAT protocols, a triage system was instituted and a separate room for children was provided in the outpatient department of hospitals that had none. An emergency room was identified and equipped to facilitate early treatment of children with emergency signs in 65 hospitals. In 2012, bCPAP project was introduced to reduce hospital based neonatal deaths. We present findings from the evaluation of the pneumonia case management in 40 hospitals, ETAT in one rural private not for profit hospital and bCPAP in 18 hospitals.

What have we achieved?
A total of 113,154 cases of childhood pneumonia were evaluated retrospectively for the period 2001 to 2012. In 105,413 cases the outcomes were known and 6,903 died giving an overall case fatality rate (CFR) of 6.6% [95% confidence interval (CI), 6.4 - 6.7%]. CFR decreased by 70.4% at the national level, from 15.2%, [CI 13.3 - 16.9%] in 2001 to 4.5%, [CI 4.1- 4.8%] in 2012, (p<0.001) (Lazzareni M, et al, in press).
For ETAT, a total of 13,959 children 0-12 years were admitted to one private for non-profit hospital from January 2010 to December 2014 and 103 (0.7%) died. Mortality was reduced by 91%, from 4.5% in 2009 to 0.4% in 2014.
bCPAP was implemented in 18 hospitals over the period July, 2013 to February, 2015. One thousand and sixty three neonates weighing more than 1 kg received bCPAP. 46% of neonates receiving bCPAP survived to discharge. Outcomes were better for neonates with normal admission temperatures; 64% of neonates with normal admission temperature survived to discharge. However, hypothermia was a pervasive challenge, and over 75% of neonates receiving bCPAP were hypothermic on admission.

Conclusions: These three interventions demonstrate that improving critical care in low resource settings where paediatricians and intensivists are not available is achievable. This has been achieved by delivering a package of interventions that include training, monitoring and provision of necessary supplies. This has resulted in integrated paediatric care services and has highly contributed in the reduction of mortality in critically ill children.
EDUCATION IN CRITICAL CARE MEDICINE IN NEPAL: AN INITIATION

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Critical care medicine is new entity for Nepal. The first Intensive care unit (ICU) was established in 1970 followed by 2nd ICU in 1984 in the Tribhuvan University Teaching Hospital in Kathmandu. MBBS course was first started in 1978 followed by post-graduation program in 1982 in the Institute of Medicine (IOM). In the last two decades with an increasing number of private hospitals and medical collages with their teaching hospitals the number of ICU beds significantly increased. There are about 90 units of ICUs with about 500 beds in Nepal. Majority of them are general ICUs and are located in Kathmandu.

The burden of critically ill patients is increasing due to aging of population and change in disease pattern. Due to development of science and technology and with innovation of new drugs, the capacity of critical care medicine is increasing worldwide. Health awareness of people has increased and there is growing concern about patient safety and the quality of care in intensive care units. With the establishment of Nepalese society of critical care medicine in 2010 the awareness of the discipline and interest among the doctors to study critical care medicine has further increased. Currently there are few ICU specialists in Nepal trained abroad. They have done fellowship in Critical care from India, Canada or Singapore. These specialists are fully dedicated to Critical care but can cover very few ICUs. Government of Nepal has planned to develop more ICUS in the country however there is no national policy for Critical care education and training to produce human resource for the country. DM critical care medicine as an educational program has just started from 2013 in the Institute of Medicine in Nepal.

The goal of DM Critical Care Medicine program is to train a super specialist in the field of Critical Care Medicine encompassing the related knowledge, clinical and communication skills, research skills and attitudes which will enable him/her to function as an independent Clinician, Consultant, Communicator, Facilitator, Collaborator, Supervisor, Manager, Health Advocate, Professional, Scholar and Research scientist in the field of Critical Care Medicine. DM critical care medicine is a 3 year full time residency program. The MD, MS postgraduates in Anaesthesiology, Medicine, surgery, paediatrics and General practice are eligible for joining the program. Selection of candidate is made through entrance exam on merit basis. The residents are rotated through various general and specialised ICUs and in emergency department, radiology, echocardiography and bronchoscopy units for needful skills.

There are regular academic activities for residents that includes case presentation, topic discussion, journal club, seminar, medical audit, case discussion, professional meeting etc. Autonomous and self directed learning is encouraged. Research work and publication are compulsory as part of residency training. For wide exposure and experience community posting in the community hospital and elective posting in the advance centre are planned for the program. Formative evaluation of the candidate is made throughout and summative evaluation at the end of residency provides final certification. We have academic collaboration with Royal college of Canada International to develop this emerging specialty in Nepal. We are having visiting faculties and teleteaching from Canada. International cooperation with optimal management of resources are mandatory to develop affordable and effective world class critical care teaching program in Nepal.
SURVEY OF RESOURCES TO MANAGE SEPSIS IN A LOW-INCOME COUNTRY ACCORDING TO THE SURVIVING SEPSIS CAMPAIGN (SSC) GUIDELINES

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Introduction: Sepsis is a potentially life-threatening complication of an infection and is a significant cause of ICU and hospital mortality worldwide. The surviving sepsis campaign (SSC) provides updated evidence based guidelines for the initial management of sepsis and septic shock. A Recent study to determine resources to implement surviving sepsis campaign guidelines and bundles found a dearth of resources in intensive care units (ICUs) among African countries. However, with limited numbers of ICU beds across the continent, most patients with sepsis will first present to their nearest health facility. Additionally the European society of intensive care medicine (ESICM) published recommendations for sepsis management in low-income countries.

Methods: This observational study was conducted as a questionnaire-based, cross-sectional survey among Ugandan primary and secondary care facilities grouped into government (public) and private hospitals. Along with the questionnaires was a checklist. The checklist contained 74 items and evaluated all material resources required to implement the most recent Surviving Sepsis Campaign guidelines. Embedded within were a checklist against which ESICM recommendations were assessed. Group comparisons were performed with the Chi2, Fishers Exact or Mann Whitney U test, as appropriate.

Results: Of 54 hospitals studied, 26 were government and 28 were missionary hospitals. The median number of beds was 189 and only six of the hospitals studied had an ICU. Drugs, equipment, and disposable materials required to consistently implement the Surviving Sepsis Campaign guidelines or sepsis bundles were less frequently available in all hospitals studied compared to those required to implement the ESICM recommendations.

Conclusions: The results of this study shows that the most recent Surviving Sepsis guidelines cannot be implemented in Uganda in their entirety, due to a shortage of required hospital facilities, equipment, drugs and disposable materials. However, availability of key resources may allow implementation of ESICM recommendations or modification of current sepsis guidelines based on available resources and implementation of a substantial number of life-saving interventions into sepsis care in Africa.
CURRENT STATUS OF CRITICAL CARE MEDICINE IN BANGLADESH

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Critical care medicine (CCM) is providing special care to critically ill and critically injured patients in a highly equipped area known as intensive care unit (ICU). Goal of critical care is to resuscitate the sickest patient by stabilizing vital signs through vital organ support and intensive monitoring.

Critical care medicine is a new concept in our country. Although CCM has been established as a super specialty in the developed countries it is still in initial stages of development and is gradually taking its shape over the last decade. In Bangladesh, first ICU was established in 1980 in National Institute of Cardiovascular Diseases (NICVD) and first officially designated Department of Critical Care Medicine was established in BIRDEM General Hospital in 1996.

Critical care medicine in a developing country like Bangladesh where resources are limited are extremely challenging. Most of the low income population can not afford the high cost of ICU. Disparity in the quality of care within different ICUs in our country is quite high. Hurdles to expansion of critical care include lack of critical care training for health care workers, inadequate number of intensivist, high cost of critical care service etc.

Critical care in our country is beyond reach in majority of people. So we need to overcome a number of hurdles in order to develop high quality critical care. Since the establishment of Bangladesh Society of Critical Care Medicine (BSCCM) in 2009 the development of this specialty has been rapid. Regular conferences (both national and international), regular Continuing Medical Education (CME) Programs and workshops have been arranged.

Critical care medicine in Bangladesh has been going through slow but steady evaluation and now facing great challenges. In spite of these challenges there has been exponential growth of ICUs in our country and we hope to make significant progress in meeting these challenges by the end of this decade.
CURRENT PRACTICES OF MOBILIZATION, ANALGESIA, RELAXANTS AND SEDATION IN INDIAN ICUS

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\textbf{Background and Aim:} Use of sedation, analgesia and neuromuscular blocking agents is widely practiced in Intensive Care Units (ICUs). Our aim was to study the current practice patterns related to mobilization, analgesia, relaxants and sedation (MARS) to help in standardizing best practices in these areas in the ICU.

\textbf{Materials and Methods:} A web-based nationwide survey involving physicians of the Indian Society of Critical Care Medicine (ISCCM) and the Indian Society of Anesthesiologists (ISA) was carried out. A questionnaire included questions on demographics, assessment scales for delirium, sedation and pain, as also the pharmacological agents and the practice methods.

\textbf{Results:} Most ICUs function in a semi-closed model. Midazolam (94.99\%) and Fentanyl (47.04\%) were the most common sedative and analgesic agents used, respectively. Vecuronium was the preferred neuromuscular agent. Monitoring of sedation, analgesia and delirium in the ICU. Ramsays Sedation Scale (56.1\%) and Visual Analogue Scale (48.07\%) were the preferred sedation and pain scales, respectively. CAM (Confusion Assessment Method)-ICU was the most preferred method of delirium assessment. Haloperidol was the most commonly used agent for delirium. Majority of the respondents were aware of the benefit of early mobilization, but lack of support staff and safety concerns were the main obstacles to its implementation.

\textbf{Conclusion:} The results of the survey suggest that compliance with existing guidelines is low. Benzodiazepines still remain the predominant ICU sedative. The recommended practice of giving analgesia before sedation is almost non-existent. Delirium remains an underrecognized entity. Monitoring of sedation levels, analgesia and delirium is low and validated and recommended scales for the same are rarely used. Although awareness of the benefits of early mobilization are high, the implementation is low.
MANAGEMENT SURGICAL ICU IN MAHOSOT HOSPITAL

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Mahosot Hospital, Lao PDR

Since 1903 Mahosot hospital was established it was the biggest unique hospital in Laos in that time. Today Mahosot hospital is still famous hospital in the country, it is general hospital consist of 450 beds and being training center for doctors and nurses. Throughout the country

From the past there is only one ICU which is in charge of monitoring and treatment every kind of critical ill patient from every service in the hospital and other hospital in Laos.

Year 2002 cardiac surgery project was started in Vientiane. It is supported by Aid Development de la Sante (ADS, Luxembourg NGO). We have performed cardiac surgery especially the children who have suffering from congenital heart disease and valvular heart disease from cardiac rheumatism.

2004 heart centre was established in Mahosot hospital. The number of cardiac surgery is increasing each year.

Anesthesiologist have to in charge not only practicing anesthesia in the operating room but have to manage post operative care and treatment for cardiac surgery patient as well. We have learned to manage some complication post operative such as pulmonary hypertension, atrial fibrillation, pericardial effusion which could lead to cardiac tamponade. This is a reason and a result of an initiation of surgical ICU in Mahosot hospital.

We still have some trouble in management of critically ill patient from other kind of surgery and we need to improve the quality and service for offering safer anesthesia and surgery for all patients.

With international support might help us to develop faster surgical ICU in Lao PDR.
CARING FOR ICU PATIENTS IN A RESOURCE LIMITED ENVIRONMENT

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Purpose: To report a case of diabetic ketoacidosis successfully managed in a limited resource setting and to explain how this was done using adapted American Diabetic Association guidelines. A review of the method used will be presented.

Methods: A 32 year old female presented with polyuria, polydipsia, fatigue, nausea and repetitive vomiting. Her laboratory tests showed a very high blood glucose from a finger stick blood sample, urine ketones 4+ and urine glucose 4+. She was diagnosed with new onset diabetes presenting as diabetic ketoacidosis. She was treated using limited laboratory investigations. Though not ideal, treatment was given by adapting the 2009 American Diabetic Association guidelines. Our treatment included the use of IV fluids, IM insulin and potassium. We do not have the capability to use IV insulin or have access to other advanced laboratory testing such as arterial blood gases.

Results: She responded well to treatment and was discharged home one week later.

Conclusion: We were able to successfully treat DKA in a limited resource environment using adapted ADA guidelines.
MORBIDITY AND MORTALITY IN THE UNIT THE INTENSIVE CARE IN HOSPITAL MARIO CATARINO RIVAS OF SAN PEDRO SULA, HONDURAS JANUARY 2014 - JANUARY 2015

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Basis: The general purpose of an Intensive Care Unit is to reset one or more altered organic systems of a patient, and thus bring them to acceptable life status. Consequently, this engenders time to heal simultaneous diseases that initially provoked such critical state, and return the patient to society in a safe manner.

Objectives: Determine the morbidity and mortality of inpatients at the Unit of Intensive Care of Hospital Mario Catarino Rivas from January 2014 to January 2015. Furthermore, identify variables that compose such study.

Methods: Consists on descriptive, transversal and retrospective study. The information required is extracted from the Unit of Intensive Care statistics book, dating from January 2014 to January 2015. The variables considered are age, sex, entry diagnosis, and mortality diagnosis.

Results: The deaths pictured were 41, representing 39.42%. Additionally, the early mortality number was 15 patients (37%), and late mortality was 26 patients (63%). The main causes of mortality were ARDS (3 cases) 7.3%, severe pneumonia (3 cases) 7.3%, septic shock (3 cases) 7.3%, pancreatitis (3 cases) 7.3%, and Closed Head Injury (3 cases) 7.3%. The number of patients studied from January 2014 to January 2015 in the Unit of Intensive care was 104. From these, 53 are male (51%) and 51 are female (49%). The bed occupancy rate was 91.5% (the hospital has 4 beds for adults) and the moderate days of stay were 16.8. The average age of hospitalized patients was 44.8 years. The main diagnosis of inpatients was Closed Head Injury, being 13 cases (12.5%). Next to this came 8 cases of severe pneumonia (7.6%), 8 cases Guillain-Barre Sindrome (7.6%), 8 cases of Septic Shock (7.6%), and 7 cases of Polytrauma (6.7%). These constitute the 5 most frequent morbidity cases throughout the whole investigation.

Conclusion: We have found that there is a predominance of the masculine sex. Moreover, the average age of mortality is 44.8 years, which indicates that it directly links to major deterioration of impoverished families. The opportunity of entering the Intensive Care Unit is scarce, due to the categorical reason that there is a preference for pediatric space over adult beds. A considered virtue is that there is no presence of any abnormal diagnosis, having cases that relate to many other studies. Nevertheless, gunshot wounds are between the ten prevailing causes of mortality in the Unit of Intensive Care, revealing the rapid growth of violence in the city.
EVOLUTION OF MECHANICAL VENTILATION IN GUATEMALA

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**Origin:** Mechanical ventilation is a therapeutic procedure commonly used for the care of critical state patients; conversely, it is associated with high mortality rates.

**Objective:** Identify the hidden mortality after prolonged Mechanical Ventilation treatment on patients that left the Unit of Intensive Care, and in the process, intervene to reduce these complications.

**Methods:** Descriptive studies and correct utilization of different ventilation modes to best fit the patients needs. Therefore, patients were monitored for 4 weeks and 2 weeks later had the Mechanical Ventilation removed.

**Results:** The study was realized in Hospital General San Juan de Dios (HOSPIGEN), Guatemala City, which had 106 deceased patients, 99 of these in the first week (66.45%) and 7 on the fourth week (3.95%). The average mortality age was 42.7 years, and the male sex was more prone to death (35% more than women). The mortality rate increased as the patient was treated for longer with Mechanical Ventilation, and there was no difference in type. As well, the subjects that were moved to other hospital areas possessed a higher mortality than those sent home.

**Conclusion:** Technological advances have provided new tools for managing critical patients with respiratory failure, but according to this study, there is no clear evidence that these exceed the results of older care techniques. The indispensable aspect in this kind of situation will always be the experience and knowledge the clinical operator possesses over these modalities, being new or traditional. Finally, we cannot fail to remember that the success Mechanical Ventilation has over the prospect will depend on the dedication and time the clinical operator used for evaluation and interaction with these ventilation support machines.
CRITICAL CARE SERVICE IN COUNTRIES WITH LIMITED RESOURCES: STRATEGIES TO IMPROVE OUTCOMES

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Hasan Sadikin Hospital is located in one of big city in Indonesia; named Bandung and this is a Governor Hospital with almost 1000 beds. But it has only 14 General ICU beds, 4 pediatric ICU, 10 Neonatal ICU and 8 Cardiac ICU. Patient monitoring system is our first concern. In this occasion I would like to share my experience in the monitoring system in general ICU. Invasive monitoring are provided but the consumable is expensive which was not affordable for most of the patients there, so most of the patients in our general hospital used only standard non invasive monitoring like non invasive blood pressure monitoring, pulse oxymetry, ECG, but central venous pressure monitoring was provided by the government health insurance.

Most of the cases in this ICU were sepsis, and sometimes we face difficulties in the patients assessment caused by the limitation of the monitoring system. We use some parameters can be drawn from blood gas analysis which is possible to check any time.

We performed a study that revealed that there were a closed correlation between PCO2 gap and Cardiac index (check by echocardiography). We also found in an observational study that nutrition therapy must be monitored since the early phase of patients admission. The success of weaning from mechanical ventilation must be supported by some scoring system, follow the recommendation from SSC, and the condition of the microcirculation. We used to evaluate the O2 balance by using blood lactate, and oxygen saturation of the blood from the central venous catheter.

We concluded that even the equipment to monitor the patients are limited but that there are still many ways to improve the patients outcome.
Epidemiology of the ICU – Acquired Infections in India

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Background: The epidemiology, microbiology and impact of Intensive Care Unit (ICU) acquired infections, such as Ventilator Associated Pneumonia (VAP), Catheter Associated Urinary Tract Infections (CAUTI), and Catheter Related Bloodstream Infections (CRBSI) have been extensively studied and reported in the western literature. However, there is paucity of literature regarding these infections in the Indian setting.

Objectives: To determine the incidence of ICU acquired infections VAP, CAUTI and CRBSI in India and to explore the microbiology and resistance patterns of these infections. The study had a secondary objective to evaluate the outcomes associated with these common ICU acquired infections.

Materials and Methods: This was a multicenter observational study, which included 15 medical and surgical ICUs across India. The study was sponsored by Indian Society of Critical Care Medicine (ISCCM) and was conducted from August 2011 to October 2012. Patients in the ICU ≥ 48 hours with any ICU acquired infection occurring within 14 days of index ICU stay were included. HIV, organ donation and burn patients were excluded. Data collection was done by allotted study personnel at all sites and entered into a web-based password-protected database. Demographic data like patients age, gender, admission diagnosis, APACHE II, history of diabetes mellitus (DM), and steroid use were noted. For each infection, specific clinical presentation details (i.e. presence of fever, leukocytosis, hypotension etc.) were collected. Patients were followed until hospital discharge or death.

Results: The total number of patients included in the study was 381 (Males - 264(69.2%); Mean age - 49.69±14.77). At least 1 ICU infection was seen in 346 patients and 35 had more than one ICU infection. Of the patients with single infections, 223 were diagnosed with VAP and Acinetobacter was the most common isolate, followed by Klebsiella. CAUTI was seen in 42 patients with Klebsiella and E. coli as common organisms. A total of 81 patients had CRBSI in whom Klebsiella was the most commonly isolated organism, followed by Pseudomonas. Multi drug resistance was very prevalent among gram negative isolates (Acinetobacter 87.5%, Klebsiella 75.5%, E. coli 61.9% and Pseudomonas 58.9%). Staphylococcus constituted a very small proportion of the isolates (2.4%). Mortality rates were 26%, 11.9% and 34.6% in VAP, CAUTI and CRBSI respectively.

Conclusion: VAP is the commonest infection followed by CRBSI and CAUTI. Multidrug resistant gram negative bacteria - Acinetobacter, Klebsiella and Pseudomonas are the most common organisms. Western guidelines hence may not be applicable to treat ICU infections at tertiary care hospitals in India.
STATE OF THE PEDIATRIC ICU IN THE PHILIPPINES

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The Philippine population as of 2012 is 97,594,040 and children ages 0-18 years old make up 46% of the total population (41,988,077). The birth rate is 2% as of year 2009 and infant mortality rate is 3%. In the Philippines the leading cause of child mortality across all age-groups is pneumonia, thereby, needing critical care services. Despite the growing population of the pediatric age group, there is still a scarcity of pediatricians (4085 to date) and pediatric intensivists (49 fellows, 7 diplomates, 6 fellows-in-training). Hence, the access and delivery of medical services, most especially in the critically ill child in the far-flung areas are not adequate.

Training centers in the Philippines are the following: University of Santo Tomas Hospital, Philippine Childrens Medical Center and Philippine General Hospital and all function as closed PICUs. The most common cases admitted in the PICU are the following: Pneumonia, post-op neurosurgical cases, severe dengue, septic shock and bronchial asthma in severe exacerbation.

The organizational structure of the pediatric intensive care units in the Philippines will also be discussed as well as the future directions of the subspecialty including liver transplantation, establishment of other training institutions and regionalization of pediatric intensive care units.
CASE PRESENTATION ON SEVERE AND COMPLICATED MALARIA (WITH ARDS) IN A PREGNANT LADY

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A previously healthy, primigravida 26 years old woman in her 14 week of pregnancy was admitted to Addis Hiwot General Hospital, Addis Ababa Ethiopia because of high grade fever, global headache, frequent vomiting and prostration of one week with dark urine and decreased urine output of three days prior to presentation to our hospital.

On the day of her admission (Day1=D1) she started to have sudden onset dry Cough, dyspnea, fast breathing and progressively worsening of change in mentation.

She lives in Addis Ababa and went to the rural area 100km away from Addis Ababa to visit her Relatives 2 weeks prior to the onset of the symptoms. The area is known for its endemicity for malaria. The patient has no history of previous malarial attack. She never received anti malarial prophylaxis before. Two days after the onset of the first symptoms she visited a health center and she was given antipyretic and was sent home.

Physical Examination revealed

Blood pressure of 90/60mmg, Temperature of 39.90c with sinoatrial tachycardia (pulse rate 126BPM) her saturation was 69% with atmospheric air.

She was deeply jaundiced with pallor.

Her pulmonary exam revealed diffuse rales on both lung fields mainly on lower lung field posteriorly.

She has hepatomegally below the costal margin and with splenomegally.

Relevant laboratory investigations included the following:

Hemoglobin level of 5.0mg/dl, hematocrit 16g%, white blood cell count 4.5K cells/ml (Diff= Neutrophil 92%, lymphocyte 6% monocytes 2%).

The platelet count was 50K cells/mm3. Blood film showed P.falciparium Ring form (trophozoite) with parasitic load of +3.

Serum creatinine was 2.8mg/dl with blood urea level of 156mg/dl and RBS=180mg/dl

Prothrombin & activated partial tissue thromboplastin time was normal. As were serum electrolyte.

The serum Transaminase was three times above the normal level with elevated Bilurubin level.

Chest X-ray showed bilateral multifocal alveolar filling process suggestive of ARDS.

With a diagnosis of sever and complicated malaria (sever Anemia, ARDS, ?ARF) she was admitted to intensive care unit(ICU) and she was started on IV Quinine with loading dose of 20mg/Kg and maintenance 10mg/Kg every eight hours. Antipyretic and antiemetic was started with feeding via NGT. She was transfused with four units of compatible blood.
As the respiratory was worsening (finally saturation became 68%) she was put on mechanical ventilator with low tidal volume and high PEEP.

On D2 of her admission she was having some clinical improvement, her hemoglobin level raised to 9.2mg/dl, hematocrit 29g% but she became anuric and her creatinine level increased to 7.4mg/dl with blood urea level of 280mg/dl.

On D3 of her admission to the ICU she was started on hemodialysis and received three sessions.

The creatinine level progressively normalized and her urine output was adequate in subsequent days.

She began to improve clinically and on the 12th day with normalization of her heart rate & biochemical profiles and negative peripheral blood film she was transferred to the ward. After a total of three 18days in the hospital stay she was discharged with improvement and her one week follow up showed significant clinical improvement.
INTRODUCING ECMO TO EGYPT

Akram Abdelbary Ahmed

Cairo University, Egypt

After retrieval of first VV ECMO case by Palmers group from Cairo, the enthusiasm grew in the critical care community to start this activity in Egypt. Many challenges and obstacles were faced which included introduction of the concept, training, economic, location and team building. And after 4 years of preparation the first ECMO case was discharged after spending 20 days on VV ECMO. Our centre now reached 10 cases of variable difficulty. We joined the ELSO, conducted two ECMO basic courses and trying to spread the knowledge in the medical community.
THE INITIAL EFFECT OF APPLYING THE EXTRACORPOREAL MEMBRANCE OXYGENATION (ECMO) FOR CARDIOGENIC SHOCK DUE TO ACUTE MYOCARDITIS

Giang Thuc Anh
Bach Mai Hospital, Viet Nam

Objective: (1) assess the efficacy of the Extracorporeal Membrane Oxygenation (ECMO) in patients with severe cardiogenic shock; (2) describe complications of the technique during the treatment.

Methods: From 2009 to 2014, 25 patients in ICU Bach Mai were enrolled into the study. The indication for ECMO was severe cardiogenic shock due to myocardial infarction and acute fulminant myocarditis unresponsive to optimal conventional treatment. Exclusion criteria: shock due to the others causes, pulmonary embolism, aortic dissection. The V-A ECMO was established using The CAPIOX emergent bypass system (Terumo Inc., Tokyo, Japan). The techniques of ECMO include veno-arterial vascular access; blood flow was adjusted gradually to the target cardiac index of 2.0 2.5 L/min/m2 and to maintain MAP above 65mmHg; FiO2 100% and titrated based on arterial blood gas and lactate; standard heparin was given by continuous infusion at a rate titrated to maintain the activated partial thromboplastin time between 40 to 45 seconds. Clinical and laboratory parameters as well as complications were collected and statistically analyzed.

Results: Among 25 patients (age of 49 ± 19; 11 to 82 year old) received the treatment, 13 patients (52%) survived; x/y patients (77%) in acute fulminant myocarditis survived. All patients were on ventilators with 2 - 4 vasopressors and inotropes, average SOFA score was above10, hyperlactatemia (7.5 ± 4.4 mmol/l) prior to the treatment. The duration of ECMO was 124.4 ± 57.9 hours. During the treatment, organ perfusion improved in all patients which evidenced by decreased SOFA score, decreased heart rate, and increased MAP above 65mmHg, urine output and PaO2/FiO2 ratio. Frequent complications were noted: bleeding at site of arterial cannula 19/25 patients (76%), infection at site of cannula 2/25 patients (8%), ischemia 1/25 patients (4%).

Conclusions: Patients with cardiogenic shock due to myocardial infarction and acute fulminant myocarditis treated with V-A ECMO had a survival rate of 52%. The survival was higher (77%) in acute fulminant myocarditis group. The frequent complications observed were bleeding, infection, ischemia that are preventable with closely monitoring.
CHALLENGES IN DEVELOPING CRITICAL CARE MEDICINE IN SRI LANKA

Rohan Dissanayake
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Establishment of the Critical care Society in 1971 was perhaps the first milestone that begun development of Critical Care Medicine as a specialty in the World. It has taken many decades to establish this specialty, especially in the developing world. Sri Lanka is no exception.

Sri Lanka took her initiative by establishment of a Critical Care Society in 2002. A Board of Study for Critical Care Medicine was established in 2008. An initiative to educate intensivists via a Diploma training program was initiated in 2009.

Since then Sri Lanka has struggled to adopt a training program to establish intensive care specialists. Whilst some held the view that it should be a sub-specialty of anesthetics; some others wanted it to be a specialty on it own since inception. Historically most developed countries adopted the latter model and succeeded.

This matter not resolved yet for Sri Lanka intensivists. The Critical Care friendly community has gained political recognition of the subject as a specialty in the country in 2011. An initiative to establish intensivists training as a sub-specialty pathway of anesthetics has failed to date. The territorial issues between specialties were to blame, similar to in some other countries. We are now at the tail end of this unfortunate obstacle that will resolve with time. We are now in the process of re-establishing a new training pathway.

In the meantime we now have a substantial number of middle grade doctors trained in intensive care in the country via the Diploma program. We are looking forward to the day when there will be consultant intensivists in the country to lead this specialty. In the meantime nurses training in critical care has progressed with substantial motivation.

Until recently, the Sri Lanka Medical Council did not recognize specialists in the register unless they had MD board certification from the Postgraduate Institute of Medicine, Colombo Sri Lanka. Since there are many specialties that have no MD training programs, the Sri Lanka Medical Council has recently decided to recognize specialists with foreign CCT as specialists. It is likely therefore, expatriates of Sri Lanka trained and completed specialist training in Critical Care Medicine elsewhere take leadership positions in Sri Lanka. The Ministry of Health of Sri Lanka should actively pursue this path to employ Consultant Intensivists and promote this specialty forward for the benefit of all those who need critical care services at one time or the other.
CHALLENGES TO CRITICAL CARE IN INDIA

Atul Prabhakar Kulkarni
Tata Memorial Hospital, India

The critical care community faces major challenges in India. We are a very young specialty in India. The awakening of the community occurred in 1993 when a group of 13 young and enthusiastic doctors gathered together in Mumbai and decided to form the Indian Society of Critical Care Medicine. Today the society has over 7000 members and 71 branches country-wide. Even then the Medical Council of India, the overarching body that regulates medical education in the country, took another 19 years to recognize Critical Care Medicine, and the super-specialty course in the specialty was thus started in 2 medical colleges in 2012.

We still face several challenges after overcoming the fight for recognition. The critical care practice across the country varies from top-of the line, world-class ICUs in corporate and private hospitals where the cost is exorbitant to poor care in public hospitals. Thus we have challenge in getting ICUs to the same standard across the country.

The prehospital care is generally poor; this affects the ICU outcomes quite often. We need to thus put together more effective and far reaching prehospital care. Another big problem is ability of the patients to pay for the poor. Most patients pay out of pocket and hence generally are unable to afford the expensive care required in the ICUs. Thus it is a challenge to get everybody under the umbrella of health insurance whose penetration in the rural areas continues to remain poor.

Another challenge to be overcome is to be ready for natural disasters and epidemics such as the SARS epidemic. We do not have a plan in place for doing this and we need to get moving towards organizing this.

We lack trained intensivists. One of the main objectives of the Indian Society of Critical Care Medicine was training of manpower. We therefore started running courses in the discipline since 1996 but we still do not have enough manpower to man the required number of ICUs.

Another major challenge is to give standardized evidence based care to patients. Our problems, such as tropical diseases and poisonings are unique to our country and western literature is silent on these. Therefore Indian Society of Critical Care Medicine has been developing guidelines and disseminating among Critical Care professionals so the standards of care improve. We run our own monthly pubmed indexed journal called Indian Journal of Critical Care Medicine and this will also go a long way in knowledge translation.

Another major hurdle is end of life care, due to various reasons. The law is silent on this, this scares the intensivists in to not offering it even when indicated. The Society therefore published a position statement in 2004.

Antibiotic resistance is a huge problem due to indiscriminate use of high end antibiotics. The society is therefore working with other professional body to solve this problem.

Last but not the least we lack our own data and we are developing a system called CHITRA which will be android based.
PEDIATRIC CHIKUNGUNYA FEVER IN HONDURAS: CLINICAL FINDINGS AND COMPLICATIONS

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Chikungunya fever (CHIK) is an emerging, mosquito-borne disease caused by an alphavirus, Chikungunya virus (CHIKV). The disease is transmitted predominantly by Aedes aegypti and Ae. albopictus mosquitoes, the same species involved in the transmission of dengue.

Traditionally, CHIKV epidemics have shown cyclical trends, with inter-epidemic periods ranging from 4 to 30 years. Since 2004, CHIKV has expanded its geographical range, causing sustained epidemics of unprecedented magnitude in Asia and Africa. Although areas in Asia and Africa are considered to be endemic for the disease, the virus has also produced outbreaks in the Indian Ocean islands and Italy. This recent reemergence of CHIKV has heightened the world’s public health awareness and concern about this virus.

In the Americas, the first cases were reported in the Caribbean in 2014; specifically in the island of St. Martin and subsequently in the Dominican Republic.

The first cases in Honduras presented in November 2014, with an increasing number of cases continuing throughout this year. According to preliminary results from the Health Surveillance Department at the Hospital Escuela Universitario (HEU), the main teaching facility in the country, 4,120 patients have been admitted to HEU since January 2015. The vast majority of patients (90%) are less than 18 years old and of these 62% are less than five years old. Since Chikungunya is a new disease in our country, no immunity has yet developed against it. A large proportion of infants and neonates have been affected by the disease, with the latter group more prone to developing atypical forms of the disease, some of which could be fatal or lead to complications, such as encephalitis.

**OBJECTIVES:**
- Describe the clinical and epidemiological characteristics and most common complications in patients less than three months old with Chikungunya Fever
- Describe the most common clinical presentation and most common complications in neonates with Chikungunya Fever

**MATERIAL AND METHODS:** An observational study that is currently being conducted in a teaching hospital in Honduras. Data collection started at the beginning of the epidemic in April 2015 and will conclude mid-August. All patients less than three months old and meeting the definition criteria of Chikungunya Fever were included in the study.

Due to financial limitations, a Chain Polymerase Reverse test was conducted in some of the patients. Preliminary results evidenced that the majority of patients suspected to have Chikungunya Fever have tested positive for the disease.

Further statistical analysis will include general demographics, Odds Ratio analysis, and Chi Square.
ICU IN HEBRON HOSPITAL IN CAMBODIA

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Hebron Medical Center, Cambodia

Purpose: To introduce the situation of ICU in Cambodia.

Methods: We surveyed two hospitals (Preah Kosamak Hospital and Hebron Hospital) in Cambodia. We studied the number of staffs and beds of ICU, facilities, patients and the common diagnosis.

Results: Preah Kossamak Hospital is one of the famous national hospital which has 14 beds in ICU. The facilities of the hospital are 4 bed side monitors, 4 ventilation machines, a defibrillator and oxygen tube. There are 3 specialists and 2 general physicians with 2 medical assistants and 14 ICU nurses. The average admission of ICU is 50 in a month and the common diseases are head trauma, spinal injury, bone fracture, post-operative care, stroke and metabolic disease, pneumonia, liver cirrhosis and heart disease. The Hebron Hospital has 3 ICU beds with 3 bedside monitors, 3 ventilation machines, a defibrillator. There is one ICU specialist and 4 ICU nurses in the hospital.

Conclusion: Critical care in Cambodia needs more development due to scarce resources, limited experience, and critical care training. However, Cambodia has a great potential for future improvement.
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Luncheon Symposium
CLOSING THE LOOP IN VENTILATION

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Proportional assist ventilation with load-adjustable gain factors (also referred to as PAV+) is a unique ventilatory mode that delivers assistance in proportion to patient effort, thereby allowing for titration of the balance between respiratory muscle capacity and load, and ensuring that the respiratory muscles are utilized throughout the breath and not just for triggering the breath. In PAV+ mode, the ventilator measures the instantaneous flow and volume generated by the patient and calculates the instantaneous pressure needed to overcome the elastic and resistive pressures based on the equation of motion of the respiratory system. Assessment of respiratory mechanics is achieved by performing automated and repeated measurements of respiratory system compliance and resistance using repeated short occlusions at the end of inspiration. This automatic adjustment has been implemented, justifying the acronym PAV"++". The level of assistance also called the "gain" delivered by the ventilator is adjusted by the clinician. It is a percentage of the total pressure needed to inflate the respiratory system, reflecting the part done by the ventilator. Because of these working principles, PAV+ is a mode in which the pressure generated by the respiratory muscles is “mirrored” by the pressure delivered by the ventilator and it therefore directly enables to estimate this muscular pressure. This can be made at the bedside from the values of the gain and the driving inspiratory airway pressure as recently shown in a multicenter study in France.

Several studies have shown short term advantages of PAV over PSV, including improved patient-ventilator synchronization, improved adaptability in response to changes patient’s demand, and, sometimes but not always, improved sleep quality.

A relatively large single centre randomized controlled trial but limited to a 48 hour period showed that significantly more patients could be ventilated with PAV+ than with pressure support ventilation, and a pilot single centre study suggested that the benefits of PAV could translate into a reduction in ICU length of stay compared to PSV. We have no definitive data, however, proving the clinical superiority of PAV for replacing pressure support ventilation.

For this purpose, we are planning a large randomized controlled trial entitled “Proportional Assist Ventilation for Minimizing the Duration of Mechanical Ventilation: The PROMIZING Study”, NCT02447692. We plan to enroll slightly more than 500 patients.

References


HEMODYNAMIC MONITORING FROM OR TO SICU - IMPACT ON SURGICAL OUTCOMES

Andrew Rhodes

St Georges Hospital, United Kindom
USING TRANSPULMONARY THERMODILUTION IN SEPTIC SHOCK AND ARDS PATIENTS

Frederic Michard
Edwards Lifesciences, Switzerland

Transpulmonary thermodilution (TPTD) has many advantages in patients with septic shock and ARDS. First, all these patients have an arterial line and a central venous access anyway, so using TPTD does not bring any additional invasiveness. TPTD allows the measurement of cardiac preload, cardiac function and vascular tone. Therefore, in patients with septic shock it is useful to titrate fluid, inotropes and vasopressors. TPTD also allows an estimation of extravascular lung water and pulmonary vascular permeability. Therefore, in patients with ARDS it is useful to predict outcome and guide therapy. Last but not least, TPTD is easy to use and non-operator dependent. In other words, all measurements can be done by nurses, at any time, in a few minutes.
HOW TO MANAGE SEVERE MRSA NOSOCOMIAL PNEUMONIA

Bin Du
Peking Union Medical College Hospital, China

Methicillin-resistant Staphylococcus aureus, or MRSA, remains one of the major pathogens in hospital-acquired infections, including nosocomial pneumonia. During the past decade, the efficacy of vancomycin, the standard of care since late 1950s, has been challenged by clinical studies suggesting treatment failure as high as 40%. In order to improve tissue penetration, vancomycin trough concentrations of 15-20 mcg/mL are recommended by clinical practice guidelines to ensure satisfactory efficacy in the treatment of complicated infections such as nosocomial pneumonia caused by MRSA, especially in the era of increasing antibiotic resistance. However, clinical evidence demonstrates that failure to achieve target trough concentrations, i.e. underdosing of vancomycin, is very common, even in the settings of therapeutic drug monitoring. Despite the potential to improve clinical outcome, increasing daily dose of vancomycin might be associated with more nephrotoxicity in critically ill patients who are already at high risk of multiple organ dysfunction due to the acute illness as well as the comorbidities. Linezolid is a member of the oxazolidinone class of drugs, and is active against most Gram-positive bacteria, including MRSA. Both animal and human pharmacokinetic studies have demonstrated that linezolid readily distributes to well-perfused tissues. Due to its significant nonrenal clearance, no dose adjustment is recommended for patients with renal impairment. As a result, linezolid remains the drug of choice in the treatment of severe nosocomial pneumonia caused by MRSA, as supported by post hoc subgroup analyses of two randomized clinical trials and one prospective randomized clinical trial (i.e. ZEPHyR study).
RENAL RECOVERY AS A QUALITY METRIC IN ACUTE RRT

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Survival has typically been the focus of studies comparing the outcomes of critically ill acute kidney injury (AKI) patients treated with different renal replacement therapy (RRT) modalities. However, recent data suggest recovery of renal function after AKI is also an important consideration for these patients. The first presentation of this symposium focuses on this topic, first addressing the relationship between AKI and chronic kidney disease (CKD), including end-stage renal disease (ESRD). The association between initial RRT modality choice and the subsequent development of long-term dialysis dependence is then addressed. Several recent observational studies demonstrating the initial use of conventional intermittent hemodialysis is associated with a significantly greater rate of development of chronic dialysis dependence (versus the initial use of CRRT) are discussed, with a focus on a particularly large, robust study involving more than 4,000 Canadian patients (Wald et al, Crit Care Med 2014).
FLUID MANAGEMENT IN CRITICALLY ILL AKI PATIENTS

Sang-Kyung JO
Ajou University School of Medicine, Republic of Korea

The broad theme of this presentation in the symposium is fluid management. Studies in which different fluid management strategies for critically ill patients, both with AKI and without AKI, have been used over the past decade are discussed. In general, these studies have demonstrated a positive association between the degree of fluid accumulation after ICU admission and mortality, both in patients with AKI and without AKI. The extent of fluid accumulation, defined as the percent fluid overload (%FO) based on the body weight at the time of ICU admission, was measured in some of these studies and also found to associate with morbid and mortal outcomes. The control of fluid balance by different RRT modalities is also discussed.
PRACTICAL MANAGEMENT OF INVASIVE FUNGAL INFECTION IN CRITICALLY ILL PATIENTS

George Dimopoulos

Medical School, University of Athens, University Hospital ATTIKON, Greece

The incidence of fungal infections in ICU patients is increasing. Candida spp are the commonest isolated fungal strains, responsible for almost 88% of fungal infections with attributable mortality from 5% to 71%. Fungal infections are associated with increased morbidity and mortality while early diagnosis is difficult because of the lack of specific symptoms and poor specificity of available diagnostic methods. The antifungal agents that mainly used are azoles, echinocandins and liposomal amphotericin B. The choice of antifungal agent depends on local epidemiology and specific properties (spectrum, efficacy, toxicity, PK/PDs, cost).
Septic shock remains the leading cause of mortality on the intensive care units (ICU). Diagnosing sepsis requires biomarkers and one of the most frequently investigated is procalcitonin (PCT).

Procalcitonin is detectable in the serum within a few hours after the onset of bacterial infection. It reaches its peak within 24 hours and then starts its decline in the case of adequate treatment with roughly a 50% decrease daily, according to its half-life. PCT differentiates bacterial infections from systemic inflammatory response of other etiologies with high sensitivity and specificity. However, PCT levels were found to be several times higher in surgical as compared to medical patients with the same gravity of septic shock. Furthermore, unspecific PCT elevations can also be found in the absence of bacterial infection. After surgery tissue injury is reflected in elevated PCT values, which peaks on the first postoperative day followed by a gradual decrease. Absolute values may differ in different conditions, but kinetics may be in the management of sepsis.

In a recent pilot study we found that after commencing empirical antibiotics, PCT kinetics within the first 24 hours showed significant differences between patients in whom antibiotic therapy proved to be appropriate as compared to those in whom it was inappropriate. In the appropriate group PCT peaked at T16 and by T24 it was already decreasing, while in the inappropriate group there was a significant and steady increase within the peak PCT concentration measured at T24. Therefore, early PCT kinetics may be a useful tool to help in tailoring and adjusting empirical antibiotic therapy for the patients actual needs earlier then microbiology, which is often false negative, results are available.

Possibly the most important advantage of using PCT, and especially PCT kinetics in assisting antibiotic therapy is the termination of treatment early according the patients individual response. There is convincing evidence that using this approach may result in a several days shorter antibiotic exposure as compared to conventional management.

Finally, PCT may help us in tailoring adjuvant therapies, such as IgM enriched immunoglobulins, or cytokine adsorbent therapy for example. Due to the lack of clear evidence the question remains: which patients would benefit the most? It follows some rationale, that adjunctive therapies may be indicated in the case of a) persistent septic shock, indicated by high dose of vasopressors and multiple organ failure with at least 2 organs involved, and/or b) no improvement after a few hours of the commencement of resuscitation and antimicrobial therapy, and c) when PCT values remain unchanged or increase.

Therefore, with a little help from PCT we can apply a multimodal, individualized therapy in which we evaluate all available data, and interpret PCT-kinetics, rather than treating fixed absolute values.
FACTORS RELATED TO THE SUCCESSFUL IMPLEMENTATION OF INTER HOSPITAL TELE-HEALTH FOR CRITICAL CARE

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When dealing with critically ill patients, telemedicine is often either delivered as a consultative service or as part of a proactive, continuous care model (e.g., eICU). The advantages and disadvantages of these differing approaches will be discussed. Although over 3 million ICU patients have been cared for by over 50 different eICU programs, heterogeneity exists among how these programs are implemented, managed, and have evolved over time. Similarly, although most programs have observed significant benefits there is also heterogeneity regarding the clinical and financial outcomes achieved. As a result, the research agenda regarding tele-ICUs has switched from attempting to determine if benefit is derived from such programs, to determining how benefit is derived. This presentation will review various practice models for ICU telemedicine and the evidence available to support specific organizational structures and clinical workflows. The factors associated with effective (and ineffective) implementation of a tele-ICU program will be reviewed.
REGIONAL VENTILATION MONITORING USING ELECTRICAL IMPEDANCE TOMOGRAPHY

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Mechanical stress alters lung physiology and induces local inflammatory responses. Mechanical ventilation can initiate ventilator-associated lung injury (VALI) and contribute to multiple organ dysfunction through triggering or exacerbating inflammatory responses in the lungs and spreading localized inflammation to the systemic circulation. Uneven intrapulmonary gas distribution can increase regional stress and lead to develop VALI, especially in the non-homogeneous lungs, even though lung protective strategy with limiting both tidal volume and plateau pressure is carried out. Therefore, regional ventilation monitoring would be beneficial to reduce VALI.

Electrical impedance tomography (EIT) is a clinically available noninvasive technique that provides dynamic tidal images of gas distribution at the patients bedside. Its measurement principle is the creation of two-dimensional transverse single-slice images based on changes in impedance distribution originating from mechanical ventilation. Studies have reported that EIT provides useful information such as lung recruitment, PEEP adjustment, lung volume estimation, and homogeneity of gas distribution. EIT enables frequent adjustment of the ventilator settings because of its radiation-free nature. EIT-guided mechanical ventilation preserved the alveolar architecture and maintained oxygenation and lung mechanics better than lower tidal volume ventilation in the saline-lavaged model.
Optimizing the Patient's Brain Function after Critical Illness: 
ICU Management via the PAD Guidelines and Beyond

OPTIMIZING THE PATIENT'S BRAIN FUNCTION AFTER CRITICAL ILLNESS: ICU MANAGEMENT VIA THE PAD GUIDELINES AND BEYOND

E. Wesley Ely

Vanderbilt University Medical Center and VA GRECC, United States
What kind of cardio-vascular parameters do we need to monitor in order to provide with the optimal patient care during perioperative period?

Large clinical trials have shown that the use of a thermo-dilution catheter itself did not improve the short-term as well as long-term outcome in the seriously ill patients. Those findings had a large impact on our practice, especially during non-cardiac surgery. The use of the catheter was highly limited to those patients in whom pulmonary arterial pressure or cardiac output in terms of Gold standard are needed to be measured for patient care or clinical study.

To analyze cardiac performance, pre-load, after-load and cardiac output should be measured in terms of traditional way of evaluation. If the patients cardiovascular system does not work properly, such analysis looks reasonable. We should elucidate the reason why it did not work in an expected way.

We should answer such questions as listed below:

- Are vascular pressures such as central venous pressure and pulmonary wedge pressure appropriate to evaluate cardiac pre-load? If it is not, what kind of parameters should be measured?
- Is vascular resistance, calculated by cardiac output and blood pressure, appropriate to evaluate cardiac after-load? If it is not, what kind of parameters should be measured?
- Is cardiac output appropriate to evaluate cardiac performance? If it is not, what kind of parameter should be measured?
- Do we have the answers for those very simple questions?
APPLIED METABOLIC MONITORING IN THE ICU

Jean-Daniel Chiche

Hôpital Cochin, France
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

Oral Presentation
IMPACT OF A MULTIDISCIPLINARY TRACHEOSTOMY CARE TEAM ON TRACHEOSTOMY CARE IN THE GENERAL WARDS

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Background/Purpose: Tracheostomy is being performed with increasing frequency for critically ill patients requiring prolonged assisted ventilation. With a greater number of patients being discharged to the general wards with tracheostomies in situ, timely review is important for consistent patient care [1]. In a retrospective review of 245 tracheostomised patients discharged from our Surgical Intensive Care Unit (SICU), 25% suffered adverse events [2]. Henceforth, we formed a multidisciplinary team to supervise ward care of these patients. This study aims to evaluate the impact of the service on tracheostomy related adverse events.

Methods: The study was conducted in our 900-bed tertiary hospital and involved all patients who received a tracheostomy during admission to the SICU from 1 January 2013 to 31 December 2013 (preservice group), and from 1 April 2014 to 31 November 2014 (post service group). Those who had a tracheostomy for ear, nose and throat pathologies were excluded.

Results: There were 61 patients in the preservice group and 29 in the postservice group. There was a decrease in incidence of desaturation (36.1% vs 10.3%, p=0.011), bleeding (4.9% vs 3.4% p=1.0) and ICU readmission rate (4.9% vs 3.4% p=0.752). In the post service group, a higher proportion of patients were decannulated (59% vs 29.6%, p=0.019) and all-cause mortality was lower (36.1% vs 6.9%, p=0.003).

Conclusions: The introduction of a multidisciplinary team to oversee the general ward care of these patients was effective, as evident by a decrease in tracheostomy related adverse events and a higher incidence of decannulation.

Keywords: Tracheostomy, Multidisciplinary team, Complication
AUTOMATIC ROBOTIC SYSTEM OF DIAGNOSING AND TREATMENT IN INTENSIVE CARE UNIT

Rozaliia Solodova, Mikhail Sokolov, Vladimir Galatenko, Vladimir Budanov, Vladimir Staroverov, Viktor Sadovnichy

Lomonosov Moscow State University, Russian Federation

Background/Purpose: Automatic robotic system has been developing in Lomonosov MSU. The system consists of three functional modules: a block of drug administration, patient monitor, the analytical unit (decision support system - processing of received information, the definition of the state, providing recommendations). Data from all devices are automatically directed to the program. The system is based on national clinical guidelines of patient care in intensive care unit. It is intended to reduce the number of medical errors.

Methods: The system performance testing was carried out on patients in intensive care unit. All diagnostic probes (pulse, ECG, blood pressure) of the system were connected to 53 patients on admission. The system asks questions step by step, analyse physiological data, make a diagnosis and suggest treatment after confirmation it starts infusions. As soon as infusion was confirmed, the system asked questions step by step, analysed physiological data, made a diagnosis and suggested relevant treatment. The system corrects velocity of drug administration according to the values of heart rate, saturation, blood pressure.

Results: In 38 cases, the system established diagnosis and it was admitted by the doctor, in 2 cases, it was not confirmed by the doctor. In 13 cases, the diagnosis of the patient was beyond worked (thromboembolism of pulmonary artery, asthmatic status, cardiopulmonary edema, acute coronary syndrome, hypoglycemic coma, septic and hemorrhagic shock, and arrhythmias). There were none side effects or unwanted sequels.

Conclusions: The robotic system helps to diagnosis in 95% of cases and suggest about first therapeutic actions. In time sensitive cases it can prevent misdiagnosis and improper treatment. Further accumulation of material is needed to prove reduction in number of medical errors.

Keywords: Intensive care, Decision support system
**LEVEL OF RESOLUTION AND MANAGEMENT OF CRITICAL PATIENTS IN THE ULDARICO ROCCA FERNANDEZ LEVEL I HOSPITAL, LIMA - PERU**

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_Hospital Nacional Edgardo Rebagliati Martins, Peru_

**Background/Purpose:** To ensure the quality of care in hospital networks increased capacity containment is required in lower-level hospitals. This involves improving their ability to solve, especially in its critical areas.

**Methods:** A cross-sectional descriptive study was conducted to evaluate the resolution ability of the hospital intensive monitoring unit, in its first four years of work, from 2007 to 2011. All patients who were referred or died were considered failures.

**Results:** 649 patients (46.5% male and 53.5% female) were treated. 204 (31.4%) were failures: 17.1% were transferred and 14.3% died. The average age was 66.26 years (SD: 19.53), the average stay was 3.27 days (SD: 3.3). The main reasons for admission were: respiratory failure type I (13.93%), severe pneumonia (13.93%), septic shock (9.83%), acute pulmonary edema (9.83%) and urosepsis (5.85%). The highest success rates were obtained in handling: severe asthma (95.45%), unstable angina (87.8%), paroxysmal tachycardia (85.71%), hypovolemic shock (84.84%), atrial fibrillation (79.31%) and acute pulmonary edema (78.57%). The main causes of failure were: type I respiratory failure, septic shock, severe pneumonia, acute myocardial infarction and renal failure. 69.4% of patients requiring mechanical ventilation were failures.

**Conclusions:** Critical care units in hospitals with low complexity can handle lots of unstable patients, particularly those whose diagnoses do not involve too much co-morbidity and/or do not require invasive procedures such as mechanical ventilation or hemodialysis.

Keywords: Critical care network, Lower level hospital
PROFILE OF ADMISSIONS INTO THE INTENSIVE CARE UNIT IN A COUNTRY WITH EMERGING ECONOMY IN WEST AFRICA

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Background/Purpose: Utilization of the intensive care unit can be more efficient with a specialized disciplinary approach. In some emerging economies, this may not be practicable as there is a case mix of admissions with utilization of the available resources in diverse patient groups. This prospective study was therefore conducted in the intensive care unit (ICU) of the University of Port Harcourt Teaching Hospital, Nigeria-West Africa over a 21 month period, to evaluate the admission pattern, patient outcome and make a proposal for future planning with improved outcome.

Methods: All patients admitted into the ICU between March 2013 and November 2014 were studied. Data of patients’ age, gender, specialty admissions, diagnosis, duration of stay and outcome were analysed using the SPSS v.20 software and presented as frequencies.

Results: A total of 397 patients were admitted with age range 1day-88years, male to female ratio 1:1.3. Admissions were from surgical 222(55.9%), obstetrics and gynecology 95(23.9%) and medical units 78(19.7%). Of the surgical patients, 85(21.4%) and 151(38.0%) were elective and emergency cases respectively. Mortality of 152(38.3%) was related to acuteness of injury and specialty, and mainly from burns and postoperative surgical patients 24(15.8%) each, and neurological 23(15.1%) and obstetric surgical patients 22(14.5%). The mean duration of stay was 4.5 ± 7.0days.

Conclusions: Though the ICU is multidisciplinary in nature, there are more postoperative admissions and mortality; therefore resources should be targeted towards improved perioperative care of these patient groups, while not overlooking the other disciplines that require critical care.

Keywords: Intensive care, Admissions, Emerging economy
REDUCING TIME FROM ACCEPTANCE TO INTENSIVE CARE UNIT ARRIVAL

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Background/Purpose: The lack of bed availability leads to patient care delays, increases complications and patient dissatisfaction. As part of our institutional continuous performance improvement goals we aimed to improve our intensive care unit (ICU) admission process by gaining a better understanding of the process through the use of industrial engineering tools.

Methods: We investigated all non-operative admissions to the ICU from 5/21/2014 to 12/31/2014 (n=929). Using standard industrial engineering techniques; process flow maps, Ishikawa diagrams and plan-do-study-act (PDSA) cycles key quality indicators affecting the admission process were prospectively collected and validated against the ICU database. The study database consisted of time of referral, acceptance, ICU arrival time, referral service and location and reason for delay in transport.

Results: Patients pulled to ICU by the Code Team or the Rapid Response Team (RRT) arrived statistically significantly faster than patients pushed to ICU from the referral location (27 vs 71 minutes p<0.001). Patient with delayed transport took 4 times as long to arrive as code and RRT patients and twice as long to arrive as non-delayed patients (105 vs 60 vs 26 min one way Anova, p<0.0001).

Conclusions: The use of the pulling technique was significantly more effective than the pushing technique in the ICU admission process. In busy units, a dedicated ICU driven transport team could lead to more efficient and time sensitive ICU critically ill patient admission. This team would work in parallel to the rapid response or code teams for a more efficient ICU admission process.

Keywords: Performance improvement, ICU admission, Patient flow, Admission delay, Transport teams
CHANGE IN THE AGE DISTRIBUTION OF PATIENTS ADMITTED TO INTENSIVE CARE UNIT OVER THE LAST DECADE AND ITS EFFECT ON CLINICAL OUTCOME

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Background/Purpose: Percentage of the elderly population in Korea has increased over the last decade. We hypothesized that mean age of the patients admitted to Intensive care unit (ICU) has increased as well. The aim of this study is to determine how the percentage of the elderly patients admitted to the ICU has changed over last 10 years and its effect on clinical outcome.

Methods: Data on 13,661 admissions to the ICU of St. Pauls hospital during the years 2005-2014 were analyzed. Patients’ age, sex, length of hospital stay, length of ICU stay and in-hospital mortality were evaluated. Mean age of the overall patients and percentages of elderly patients (>70 years) each year were also evaluated.

Results: The median age of the patients was 60.84 in 2005 and increased every year to 68.34 in 2014. Length of hospital stay increased from 19.00 days in 2005 to 24.15 days in 2012. Length of stay in ICU also increased from 4.67 days in 2005 to 5.85 days in 2013. Percentage of patients older than 70 years increased gradually from 27.4% in 2005 to 52.3% in 2014. However in-hospital mortality calculated each year did not increase over 10 years.

Conclusions: The length of hospital stay and ICU stay increased with annually growing percentage of elderly patients in ICU. With ageing of the population, different approach for intensive care will be necessary.

Keywords: Elderly, ICU, Age, Old
THE OUTCOMES OF DELIRIUM PREVENTION NURSING INTERVENTION IN SURGICAL INTENSIVE CARE UNIT

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Background/Purpose: Hospital-acquired delirium is a known risk factor for negative outcomes in patients admitted to surgical intensive care unit. Delirium is associated with longer hospital and intensive care unit length of stay, increased ventilator days, higher costs and development of cognitive impairment and dementia. The purpose of this study was to evaluate the efficacy of the delirium prevention nursing intervention admitted to the SICU.

Methods: A prospective pre-or post-intervention cohort study was done. The intervention consisted of provide formal orientation, friendly environment, nonpharmacologic sleep enhancement. Primary outcomes were incidence of delirium and delirium duration. Secondary outcomes were ventilator day and SICU length of stay. Delirium was measured using the confusion assessment method for the ICU. Data were analyzed using Chi-squared and t-test.

Results: Of 463 patients admitted to the SICU, 188 met inclusion criteria: 100 patients pre-intervention (2013.5/1-9/30) and 88 patients post-intervention (2014.5/1-9/30).Cohorts were similar in age, gender, APACHE II et al. Experienced delirium at same incidence as the pre-post intervention cohort (pre 14 (41.0%) vs 32 (36.8%)). Onset Delirium at the same incidence (pre 2.6±1.5 vs post 2.1±1.6, p=.45). But Significantly decreased duration (pre 15.3±19.5 vs post 8.9±7.9,p=.05). After intervention patients with delirium decreased ventilator day (pre 14.5±14.6 vs post 11.2±8.9, p=.30), using sedative drugs (pre 11.8±19.8 vs post 8.2±6.2, p=.34), shorter SICU LOS (18.6±19.9 vs 11.8±12.8, p=.09).

Conclusions: Continued delirium prevention nursing intervention would be anticipated for decreasing the delirium.

Keywords: Delirium prevention, Nursing intervention, Surgical ICU
PREDICTIVE VALUE OF THE BISPECTRAL INDEX FOR BURST SUPPRESSION ON DIAGNOSTIC ELECTROENCEPHALOGRAM DURING DRUG-INDUCED COMA

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Background/Purpose: Cortical diagnostic electroencephalogram (EEG) is the gold standard for brain monitoring and drug titration during drug-induced coma. Cortical EEG is labor intensive, costly, and difficult to maintain uniform competency. Bispectral index (BIS) monitoring is less expensive, less labor-intensive, easier to both interpret and maintain competency. Study purpose is to illustrate predictive value between BIS and EEG in determining degree of burst suppression during drug-induced coma.

Methods: Patients receiving drug-induced coma/EEG monitoring were enrolled in this prospective, observational cohort study. Variables recorded per minute include degree of cortical EEG burst suppression, burst count, BIS value over time and suppression ratio (SR). Pearson product moment and Spearman rank coefficient for BIS value and SR versus burst count were performed. Regression analysis was utilized to plot BIS values versus bursts/minute on EEG as well as SR versus burst count on EEG.

Results: 1,972 data sets over 33 hours of EEG/BIS monitoring. Regression coefficient of 0.6673 shows robust predictive value between EEG burst count and BIS SR. Spearman rank coefficient of 0.8727 indicates strong inverse correlation between EEG burst count and BIS SR. Pearson correlation coefficient between EEG versus BIS burst count was .8256 indicating strong positive correlation. Spearman rank coefficient of 0.8810 and Pearson correlation coefficient of 0.6819 showed a strong correlation between BIS value versus EEG burst count.

Conclusions: Statistical testing and graphing variables from multimodal monitoring show strong correlation and predictive value during drug-induced coma. This study supports using BIS value, SR, and burst count to predict degree of cortical EEG suppression during drug-induced coma.

Keywords: Burst suppression, Cortical EEG, BIS
NURING EXPERIENCES OF CARING FOR BURNS PATIENCE WITH SEPSIS IN CRITICAL CARE UNIT IN SOUTH WEST NIGERIA (CASE STUDY NOHI LAGOS)

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Background/Purpose: The goal of patients entering critical care is survival. The nursing aim is to enable the patient recover. Despite the application of standard precaution/towards infection prevention/ control, burn patients get infected (21% of admitted cases in 2014) in our acute burn unit. Despite the application of modern technologies and intensive care, burn patients with sepsis presents a very poor prognosis, exposing the nursing team to physical repercussions of stress and eventual grief.

Methods: A Heideggerian phenomenological approach. Ten registered Nurses; 5 trained in critical care and 5 trained in burns and plastic nursing were interviewed in 2014. Interviews were recorded with an audio tape and then transcribed. Athematic analysis was carried out using colaizze’s framework.

Results: Generally 5 key themes were identified: Sepsis in burn patient generate chronically critically ill patient in CCU; First aid culture; a pre-cause to infection; Work related stress; compassion fatigue; financial embarrassment and sourcing for materials.

Conclusions: Nurses described a system of job monotony. Poor patient outcome leads to occupational stress and ultimate burnout which leads to brain drain and subsequent shortage of Critical Care Nurses in Nigeria.

Keywords: Burn patient, Sepsis, Chronically ill, Burnout
ORGANIZATIONAL CULTURE AND WORKPLACE BULLYING IN NURSES

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Background/Purpose: Workplace bullying has been perceived as one of the serious problems in the nursing profession. The purpose of this study was to identify the relationship between nursing organizational culture and workplace bullying in Korean nurses.

Methods: Participants were 298 hospital nurses in B city of Korea. The nursing organizational culture and workplace bullying in nurses were surveyed using structured questionnaires from July 1st through August 15th, 2014.

Results: Participants were aware of their organizational culture as rank-oriented (45.5%), relation-oriented (36.0%), innovation-oriented (10.4%), and task-oriented culture in order (8.1%). The prevalence of workplace bullying was 15.8% according to the operational bullying criteria. A multivariate logistic regression analysis revealed that the risk of being bullying victim was 2.58 times higher in nurses of rank-oriented culture than in those of relation-oriented culture (OR=2.58, 95% CI: 1.12-5.94).

Conclusions: The above results have suggested that nursing organizational culture impacts on workplace bullying in Korean nurses. Further research is needed to develop interventions that can foster relation-oriented culture to prevent workplace bullying in nurses.

Keywords: Nurse, Workplace, Bullying, Organizational culture
METHODS FOR GLYCAEMIC CONTROL IMPLEMENTED IN NHS INTENSIVE CARE UNITS IN THE UK: A CROSS-SECTIONAL STUDY IN SEVEN HOSPITALS

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Background/Purpose: The management of stress hyperglycaemia has not been standardized. As part of GlyCon study, the methods for glycaemic control implemented in seven intensive care units (ICUs), and the views expressed by those who work within them, were explored.

Methods: A document review of protocols for glycaemic control was undertaken and an online survey was sent to all nursing and medical staff of seven ICUs within a UK-based ICU network. The survey included questions on effective glycaemic control, treatment of different degrees of hypoglycaemia, and deviations from protocol recommendations.

Results: The protocols implemented in the seven ICUs differ greatly in their target patients, target glycaemic levels, recommended methods for monitoring, and insulin titration algorithms, among others. Over half of the 40 respondents to the survey opined that a patient spending less than 75% of the admission time within the target glycaemic ranges constituted poor glycaemic control (Fig. 1). Most of the proposed protocol deviations were considered as major by at least two thirds of the respondents. The exceptions were: a glycaemic measurement missed once, an insulin infusion restarted two or less hours late, and a rescue glucose bolus administered 15 or less minutes late, which were considered as minor by more than half of the respondents.

Conclusions: There are considerable differences among the protocols implemented in the ICUs, and among the opinions of professionals working within them, regarding various aspects of glycaemic control. The effectiveness and safety of methods of glycaemic control are influenced by the attitudes of professionals towards these methods and their aims.

Keywords: Glycemic control, Protocols, Standards, Survey
DEVELOPMENT OF THE TRANSITIONAL CARE PROGRAM AND ITS EFFECT ON PATIENTS DISCHARGED FROM THE INTENSIVE CARE UNITS

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Background/Purpose: Continuity of care is important when patients admitted to intensive care units (ICUs) return to the wards and nurses must ensure it. This study aimed to develop the transitional care program for continuity of care for ICU patients and to evaluate its effects including the number of readmissions to ICU, the unexpected deaths, the number of rapid response team consultancy, and satisfaction with care.

Methods: The program was developed through a literature review and validation of an expert group. This study used a randomized control-group pretest-posttest design. The developed program was tested with 33 patients of the experimental group and 35 patients of the control group in a medical intensive care unit in a tertiary hospital in Seoul. Data were collected from February 2014 to May 2014 and analyzed by descriptive statistics, t-test, Mann-Whitey test, x² test, and Fishers exact test using the SPSS/Win statistical program.

Results: Satisfaction with transitional care of experimental group was significantly higher than that of control group (p=.007). There were no significant differences in the number of readmissions to ICU, the unexpected deaths, and the number of rapid response team consultancy.

Conclusions: The developed transitional care programs are proved to be effective to provide the continuity of care. To identify more positive effects of the transitional care, application of this program to clinical practices during longer period can be recommended.

Keywords: Health transition, Intensive care units, Continuity of care
VALIDATION OF A COMBINED ANALGESIA & SEDATION PROTOCOL FOR ICU PATIENTS

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Background/Purpose: The purpose of this study was to develop and validate a combined, evidence based analgesia and sedation protocol for ICU patients is to allow effective and timely titration of both sedatives and analgesics which may reduce the duration of incidence of adverse effects associated with these medications.

Methods: The study occurred in a large tertiary referral hospital in the Middle East. The study population consisted of patients within a medical & surgical ICU. The study design was prospective using a convenience sample of 30 patients. Sedation and analgesia assessment tools were selected. Times to achieve the desired sedation and analgesia scores were collected and compared to pre-implementation times.

Results: The average number of hours to achieve the desired sedation and analgesia score was 5.567 in the protocol group and to 19.367 in the pre-implementation group (t = -12.5716, p-value <0.001). The protocol also reduced the number of necessary titrations by almost 6 in the subsequent hours, p-value < 0.001). The numbers of adverse reactions in the protocol group and pre-implementation group are respectively equal to 0 and 0.3 (t = -2.7572, p-value = 0.009).

Conclusions: Despite the lack of randomization and relatively small sample size, the protocol demonstrates that sedation and analgesia infusions can be safety titrated together to achieve the desired level of sedation and pain relief in a short period of time, thus reducing the adverse effects of over sedation and analgesia usage.

Keywords: Sedation, Analgesia, Combined, Protocol
THE ROLE OF CENTRAL VENOUS CATHETERS MANAGERS AND EFFECTIVENESS OF REDUCTION CLABSI IN SURGICAL INTENSIVE CARE UNIT

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Background/Purpose: The use of central venous catheters (CVCs) is an integral part of critical care for the not only injection of medication and parenteral nutrition, but also the access of hemodynamic monitoring and hemodialysis. However, CVCs related infections are occurring 5~26% patients. These serious infectious complications are associated with increased morbidity, mortality, and health care costs. This study is to analyze the effectiveness of CVCs managers for the prevention of CLABSI (Central-Line Associated Bloodstream Infection) between each 9 months in Surgical Intensive Care Unit (SICU).

Methods: With a retrospective study, the prevalence of CLABSI was compared between the Pre-intervention period (PRE, January.2013~September.2013) and the Post-intervention period (POST, October.2013 ~ June.2014) each 9 months in Surgical ICU. CVCs manager performed daily rounding to check the condition of CVCs and if required dressing following CDC guidelines. Managers reported to the physicians the status of CVCs as soon as inflammation signs detected.

Results: 242-patients from Pre-intervention periods and 196-patients from Post-intervention periods were analyzed except patients with early discharge within 48 hours and without Central line. There is not any significant difference between two groups related to Age, Gender, Reason for ICU admission, ICU admission route, APACHE II score, Ventilator day and Length of stay in ICU. Incidence rate ratio (IRR) was reduced 2.5 in the post intervention (1.46/1000 device days) compared to pre intervention (3.67/1000 device days).

Conclusions: Since patients in Surgical ICU have inserted Central-Line with operation, it is difficult to decrease the use rate. However, it is assumed that organized and constant interventions by CVCs managers can effectively decline CLABSI.

Keywords: CLABSI
SELF-DESCRIBED NURSING ROLES EXPERIENCED DURING CARE OF DYING PATIENTS AND THEIR FAMILIES: A PHENOMENOLOGICAL STUDY

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Background/Purpose: Critical care nurses frequently care for and have multiple roles during care of dying patients and their families. Role confusion, stress and personal context of perceiving death may add to job stress. Little is known about roles experienced or how these roles affect bedside nurses while caring for dying patients and their families. Study purpose was to understand roles encountered by critical care nurses while providing all aspects of end-of-life care.

Methods: A descriptive phenomenological study using a purposive sampling strategy recruited 19 critical care nurses with experience caring for dying patients and their families. Individual interviews were conducted, audio-recorded and transcribed verbatim. Each nurse was asked open-ended questions about their experience and roles including when caring for dying patients and their families. Coliazzis method of data analysis was utilized to inductively determine themes, clusters and categories. Data saturation was achieved and methodological rigor was established.

Results: Main roles were described as patient advocacy, educating and supporting patient and family, optimal symptom management and promoting a comfortable, dignified death. Roles evolving from the data included encouraging family presence during the dying process, protecting and creating positive memories for families. Role-modeling coping and self-care skills while mentoring and teaching novice clinicians was important.

Conclusions: Study results have important implications for practice, education and research. Nurses may be unprepared for roles encountered during end-of-life care. Teaching these roles in nursing education and orientation classes is essential. Future research can determine best practice to mentor, teach and prepare nurses to provide optimal end-of-life care.

Keywords: Nursing roles, Patient/family advocacy.
PROVIDING THE ICU DIARY AS A THERAPEUTIC TOOL TO AID IN RECOVERY FROM PSYCHOLOGICAL DISTRESS AND IMPROVE THE SATISFACTION OF PATIENTS AND FAMILIES AFTER RECEIVING INTENSIVE CARE

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Background/Purpose: Intensive care unit (ICU) survivors often suffer from psychological complications after receiving care from ICU. To improve the quality of patient’s life after ICU care, we provided the ICU diary for ventilated patients.

Methods: Thoracic surgery ICU had implemented the ICU diary to patients on mechanical ventilation. Diaries were written by both their families and the staffs to help them understand their ICU stay and to share their concerns and feelings. The diary was simply designed to create the therapeutic relationship between the medical staff and their families. The staff narrates daily events and shares the plan so that the patient and their families could understand the condition of the patient.

Results: ICU diary helps patients to understand what has happened to them and fill the gaps of memory when they were unconscious or sedated. Family members enabled to connect with the patient by writing diaries about their presence and expressing their love and affection. It had provided an opportunity of humanizing experiences in ICU.

Conclusions: Through the ICU diary, family members not only became aware of their role as a member of caring group but also understood medical information and the patient’s condition better. Patients and relatives were able to receive patient-family centered treatment with the diaries.

Keywords: ICU diary, Patient-family centered treatment, Communication
A CLINICAL STUDY OF PREDICTIVE FACTORS ASSOCIATED WITH BLEEDING CONTROL IN MULTIPLE TRAUMA PATIENTS WITH MASSIVE BLEEDING

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Background/Purpose: Uncontrolled bleeding is the main cause of death that occurs within a few hours after the injury in multiple trauma patients, this study was performed to derive the predictive factors associated with the prognosis related in bleeding control in multiple trauma patients underwent massive transfusion.

Methods: 52 multiple trauma patients who treated more than 10 unit packed red cells within 24 hours after injury at Asan Medical Center, Seoul, Korea from January 2011 to February 2013. The initial clinical parameters of the 38 surviving patients whose massive hemorrhage was controlled and 11 non-surviving patients who died of the uncontrolled hemorrhage were retrospectively reviewed.

Results: There was no significant difference between the survivors groups and non-survivors groups in age, gender, initial vital signs, and hemoglobin. There were 4 patients with the coagulopathy in the survival group (10.5%) and 5 patients with the coagulopathy in the non-survivors five (45.5%) (p = 0.019). The required total amounts of transfusion were significantly lower in survivor groups (46.2 ± 38.8) than in non-survivor groups (82.7 ± 66.1) (p=0.025). The proportion of patients who treated transfusion above 0.6 in the ratio of FFP and PRC was significantly lower in survivors group (36.8%) than in non-survivors group (72.7%) (p=0.046).

Conclusions: Early coagulopathy accompanied in multiple trauma patients with massive bleeding can be considered as a predictor of poor prognosis. Multiple trauma patients with coagulopathy require more aggressive transfusion and more rapid surgical intervention for the bleeding sites.

Keywords: Massive transfusion, Coagulopathy, Multiple trauma
LONG TERM OUTCOME FOLLOWING DECOMPRESSIVE CRANIECTOMY FOR SEVERE TRAUMATIC BRAIN INJURY

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**Background/Purpose:** The aim of this study was to assess the impact that injury severity has on long term outcome and surgical complications in patients who have had a decompressive craniectomy for severe traumatic brain injury (TBI) over a period of ten years in the two neurotrauma hospitals in Western Australia.

**Methods:** This is a prospective observational cohort study. The CRASH (corticosteroid randomization after significant head injury) collaborators outcome prediction model was used to stratify patients according to injury severity. Clinical and radiological data on initial presentation was entered into the web-based model and the prediction of an unfavourable outcome was compared with the observed outcome at eighteen month follow up.

**Results:** Amongst a cohort of two hundred and seventy patients, comparing the predicted outcome with the observed long term outcome provided an objective assessment of the most likely outcome following surgical intervention (Figure 1). The ability of the model to differentiate between unfavorable and favorable outcomes at 18 months was good, however, the model calibration was not perfect. The predicted risk of unfavorable outcome was also strongly associated with post-operative complications.

**Conclusions:** The CRASH collaborators prediction model appears to be a valuable tool which can be used as a surrogate index of injury severity to stratify patients according to injury severity. Used wisely, the CRASH model may add to a clinician’s ability have better informed conversations with colleagues and patients’ relatives about realistic long term outcome expectations following surgical intervention in the context of severe traumatic brain injury.

Keywords: Decompressive craniectomy, Neurotrauma, Outcome

![Figure 1](image-url)
FEASIBILITY OF FULLY AUTOMATED CLOSED-LOOP VENTILATION (INTELLIVENT-ASV) FOR PATIENTS WITH TRAUMATIC BRAIN INJURIES IN THE ICU

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Background/Purpose: Neuroprotective strategy for the patients with traumatic brain injuries (TBIs) requires adequate ventilation and oxygenation for the first 24 hours post trauma. Intellivent-ASV (Hamilton Medical, Switzerland) is a recently released fully automated closed-loop ventilation that adjusts both ventilation and oxygenation parameters. The aim of this study is to evaluate the feasibility of maintaining normocapnia by using Intellivent-ASV for TBI patients.

Methods: We conducted a retrospective study comparing automated ventilation (AV) and conventional ventilation (CV) for patients with TBIs requiring neuroprotective strategy in our ICU from June 2014 to December 2014. Patients under 18 years of age or demised within 24 hours were excluded. Arterial blood gas assessments were performed every 6 hours and on demand for the first 24 hours. The numbers of manual intervention, the level of PCO2 and the numbers of unacceptable PCO2 level (>45mmHg, <35mmHg) during neuroprotective period were assessed.

Results: A total of 12 consecutive patients was included. The AV group had 5 patients and the CV group had 7. The numbers of the intervention were significantly lower (2.0 [1.0-2.5] vs 5.0 [3.0-7.0]; P=0.007). However, the level of PCO2 was not different (43.3 [38.4-43.9] vs 42.1 [40.3-45.2]; P=0.75) and the numbers of unacceptable PCO2 level were not different between groups (1.0 [0-2.0] vs 1.0 [0-3.0]; P<0.50). There was no safety issue requiring premature interruption of Intellivent-ASV.

Conclusions: Intellivent-ASV can be alternative or even better device for maintaining adequate ventilation with TBI patients. The reduced numbers of the intervention decrease workload, the risk of human errors, and may reduce inadequate ventilation time.

Keywords: Traumatic brain injury, Neuroprotective strategy
CLINICAL REVIEW OF VENTILATOR-ASSOCIATED PNEUMONIA (VAP) IN POLYTRAUMA PATIENTS

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Background/Purpose: Severely injured patients who are unconscious, shock state or underwent brain or chest injury, need long-term mechanical ventilator support, resulting inevitably in ventilator-associated pneumonia. The aim of this study was to assess attributable risk factors, clinical outcomes and bacterial pathogens of VAP in polytrauma patients.

Methods: In this retrospective study, we reviewed 118 patients requiring mechanical ventilation for >48hrs among polytrauma patients admitted in surgical intensive care unit (ICU) between January 2011 and December 2013. The age, sex, injury severity score (ISS), regional abbreviated injury scale (AIS), unconsciousness on arrival at emergency room(ER), shock state, level of lactate, massive transfusion <24hrs, hospital length of stay(LOS), ICU LOS, ventilator day, and mortality were analyzed between VAP-negative group (n=72, 61%) and VAP-positive group (n=46, 39%).

Results: Regarding the incidence of VAP, the age (43.8 ± 18.4 Vs. 54.6 ± 20.1, p=0.03), AIS of chest (2.98 ± 0.70 Vs. 3.39 ± 0.71, p=0.01) and unconsciousness on arrival (22 (30.6%) Vs. 28 (60.9%), p=0.002) showed statistically significant differences. VAP-positive group had significantly longer stay in the ICU (11.15 ± 10.98 Vs. 22.39 ± 14.9, p<0.001), ventilator day (9.43 ± 10.72 Vs. 19.83 ± 15.62, p<0.001) and higher rate of tracheostomy (19 (26.4%) Vs. 35 (76.1%), p<0.001) than the VAP-negative group. However, there were no significant differences in hospital LOS (27.78 ± 19.98 Vs. 36.57 ± 18.65, p=0.18) and mortality (12(16.7%) Vs. 3(6.5%), p=0.157). In multivariate analysis, age and lung injury score were analyzed as risk factors associated with VAP.

Conclusions: The VAP of polytrauma patients showed a significant increase of ICU LOS, ventilator day and the rate of tracheostomy but had not correlated with mortality. Because of the older age, high AIS of chest were relevant with VAP, those who have these risk factors should be monitored and treated carefully in respect to the incidence of VAP.

Keywords: Polytrauma, Ventilator-associated pneumonia
Background/Purpose: Current Brain Trauma Foundation guidelines recommend the early use of enteral nutrition to optimize recovery following traumatic brain injury (TBI). The aim of this study was to examine the effect of super early feeds (≤24 hours) on clinical outcomes after TBI.

Methods: We performed a 3-year retrospective chart review of all TBI patients who presented to our trauma center. Patients with severe TBI (GCS<8), who were intubated, admitted to the ICU and received tube feeds during ICU admission were included. Super early tube feeds (Super early-TF) was defined as beginning of tube feeds within 24 hours while Early tube feeds (Early-TF) was defined as beginning of tube feeds after 24 hours, of ICU admission. Outcome measures were pneumonia rates (defined by positive BAL), days on ventilator, hospital and ICU length of stay, hospital costs, and mortality rates.

Results: A total of 90 patients (Super early-TF: 58, Early-TF: 32) were included of which 73.3% were male, mean age was 42±20 years, and median h-AIS was 4 [3-5]. There was no difference in age (p=0.1), h-AIS (p=0.5), or admission GCS (p=0.9) between the 2 groups. Patients with Super early-TF had a statistically significant longer ICU length of stay as compared to those who had Early-TF. Outcomes of our population are shown in Table 1.

Conclusions: Although early tube feeds are known to improve outcomes in TBI patients, our data suggests that super early feeds in TBI patients may actually have trends toward worst outcomes and greater hospital resource utilization.

Keywords: Traumatic brain injury, Early nutrition, Enteral nutrition, Super early feeds
DEVELOPMENT OF SEPSIS RATES AND COSTS IN GERMAN HOSPITALS

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Background/Purpose: Sepsis is a life-threatening condition following acute infections; it is a global public health disaster. Current epidemiological data on incidence, mortality and costs of sepsis are missing in Germany.

Methods: We performed a nation-wide analysis of coded sepsis cases from 2007 to 2013 based on diagnosis related groups, hospital statistics, and causes of death statistics. Costs were estimated based on data issued by the German Federal (Social) Insurance Office.

Results: Sepsis incidence increased by overall 15% from 110,653 to 252,812 cases. Mortality was 30.5%, resulting in over 75,000 deaths per year. Sepsis now ranks third among the causes of death in Germany. Average direct costs/patient amounted to 36,129 Euros; total costs are estimated at approximately 9.1 billion Euros or 3% of the national health care budget. Hospital Statistics use microbiological sepsis codes which considerably underestimate the incidence derived from clinical sepsis codes.

Conclusions: Incidence and mortality of sepsis in Germany are higher than expected and are on the rise. Transectorial quality measures in other countries have contributed to a considerable decrease of mortality. Similar measures are urgently needed in Germany. Monitoring of sepsis indices should become a regular feature of the Federal Health Monitoring and Hospital Statistics reporting.

Keywords: Sepsis, Incidence, Epidemiology, Diagnosis related
INTENSIVE CARE UNIT MORTALITY IN SUB-SAHARAN AFRICA: THE MODIFIED SEQUENTIAL ORGAN FUNCTION ASSESSMENT SCORE

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Background/Purpose: Sub-Saharan Africa has a significant and growing burden of critical illness. Limited medical infrastructure including workforce shortages aggravated by late presentation of patients contribute to high mortality for a young critically ill-population. With little known about organ dysfunction in Sub-Saharan Africa, we set out to evaluate the feasibility and utility of the modified Sequential Organ Function Assessment score (mSOFA) in a low income country.

Methods: We are conducted a study in Mulago National Referral Hospital general Intensive Care Unit on patients 12 years and above. The mSOFA scores were calculated at admission and 48 hours and then followed up with mortality as primary outcome. The mSOFA score was modified by replacing the PaO2/FiO2 ratio with SpO2/FiO2 ratio.

Results: Interim analysis had 118 patients; the median age 34 years, 57.6% male and the overall ICU mortality 47.5%. Only 47% had blood gas analysis results. By comparison, the non-survivors had significantly higher initial, mean and highest mSOFA scores (p=0.007, p=0.000, p=0.000 respectively). The delta mSOFA scores were also significantly different (p=0.000). The logistic regression analysis showed no significant association mSOFA scores with mortality. The length of stay had an odds ratio for mortality 0.49; 95% confidence interval, 0.34-0.79; p = 0.000 while the duration of ventilation had an odds ratio for mortality 1.03; 95% confidence interval, 1.01-1.04; p=0.000

Conclusions: The modified SOFA score is feasible in low income country though it was not statistically significant for mortality but this was because of the small sample size. The study is still ongoing with a plan to include two more ICUs.

Keywords: mSOFA, Low-income country, Delta mSOFA
CHARACTERISTICS AND OUTCOMES OF CRITICALLY ILL CANCER PATIENTS ADMITTED TO KOREAN INTENSIVE UNITS: MULTICENTER STUDY

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Background/Purpose: We assess the characteristics and outcomes of critically ill cancer patients who were admitted to intensive care unit (ICU), and identify the predictors of their ICU outcome.

Methods: This is a sub-study of the validation of the SAPS3 in Korean intensive care units (VSKI), a prospective, multicenter, cohort study which included patients from 22 participating ICUs in 15 tertiary or university-affiliated hospitals from 1 July 2010 to 31 January 2011.

Results: Of the 4617 patients enrolled in the VSKI study, 833 (18%) had a malignancy, 658 (79%) had solid cancer and 175 (21%) had hematological cancer. Patients of hematological cancer had higher severity of illness and frequency of severe sepsis and septic shock than patients of solid cancer on ICU admission. Also, the need for vasopressor, continuous renal replacement treatment, and mechanical ventilation were significantly higher in patients of hematological cancer. ICU and in-hospital mortality rates were higher in patients of hematologic cancer than in patients of solid cancer (41.7% vs 24.6%; p < 0.001, 53.1% vs 38.6; p = 0.002). Age, ECOG, need for mechanical ventilation and SAPS3 were independently associated with in-hospital mortality in patients in solid cancer, while the need for mechanical ventilation and SAPS3 were independent risk factor for fatal outcome in patients in hematological cancer.

Conclusions: Mortality rate for ICU and in-hospital in patients of hematological cancer are worse than patients of solid cancer admitted to the ICU. When admitting ICU in these patients, age, ECOG, need for mechanical ventilation and SAPS3 are important variables to take into consideration.

Keywords: Cancer, Intensive care unit, Outcome, SAPS3
RISK FACTORS OF ICU READMISSION WITHIN 48HRS IN THE CRITICALLY ILL CANCER PATIENTS

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Background/Purpose: The risk factors for intensive care unit (ICU) readmission in the critically ill cancer patients are poorly understood. We evaluated the risk factors associated with the readmission of ICU in the critically ill cancer patients.

Methods: We retrospectively identified patient unplanned ICU readmission within 48 hours following ICU discharge. Data were collected for all cancer patients admitted to medical ICU of Samsung Medical Center between January 1, 2011, and December 31, 2012. If patients were repeatedly admitted to the ICU during study period, first ICU admission was used as the index event.

Results: All patients 18 years or older who were consecutively admitted to the ICU were enrolled (n = 1039); patients who died during 1st ICU admission (n = 265) or patients who discharged from ICU for palliative care (n = 83) were excluded from final analysis. The primary outcome variables were unplanned readmission (n = 41). Using logistic regression analysis, the factors associated with ICU readmission were COPD [odds ratio (OR) 4.96, 95% confidence interval (CI) 1.41-17.46], major organ involvement (OR 2.20, 95% CI 1.05-4.64), mechanical ventilation during 1st ICU stay (OR 2.33 95% CI 1.12-4.85), ECOG over 3 (OR 2.13, 95% CI 1.05-4.35), heart rate over 114 /minute (OR 4.05, 95% CI 1.91-8.61) and respiratory rate over 25 /minute (OR 2.53, 95% CI 1.15-5.56).

Conclusions: COPD, major organ involvement, mechanical ventilation during ICU stay, poor ECOG, tachycardia and tachypnea put critically ill cancer patients at risk of ICU readmission.

Keywords: Reamission, Intensive care unit, Risk factors
THE INCIDENCE OF POST-OPERATIVE HEMORRHAGE AND HEMATOMA WITH SURGICAL DRAINAGE OR EVACUATION IN THE UNITED STATES FROM 2000-2012

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Background/Purpose: Post-operative hemorrhage is a major risk factor for all surgical procedures and is the cause of significant morbidity and mortality for surgical patients. The purpose of this study is to report the incidence and assess the impact of teaching institutions and gender in this condition.


Results: During the thirteen years study period, HCUP reported the incidence of post-operative hemorrhage varying from 2.381 to 2.668 per 1000 surgical admissions which was significantly less at the end of the study period (P-Value <0.000). When assessing the impact of teaching institutions, adjusted rates were significantly higher among teaching institutions during most of the study period, (P-Value <0.000). Furthermore the adjusted rate was significantly higher in males during all years of the study, (P-Value <0.000).

Conclusions: Our data indicates that the risk of post-operative hemorrhage is higher in patients undergoing surgical procedures at teaching institutions for most of the study years, which could be the result of several factors; Teaching institutions tend to be Level 1 trauma centers with unstable patients undergoing emergency surgeries, which may carry significant risk of morbidity and mortality. We also reported a higher rate of post-operative hemorrhage in males, which may be due to larger numbers of injury related visits to emergency departments and more surgical procedures per year. Additional prospective studies should be undertaken to determine the cause and contributing factors that impact post-operative hemorrhage.

Keywords: Post-operative hemorrhage, Healthcare cost and utilization project.
CONSENT FOR LIFE SAVING DECOMPRESSIVE CRANIECTOMY: AN OBJECTIVE MODEL

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Background/Purpose: The aim of this study was to explore the issue of consent when considering the use of a lifesaving but not necessarily restorative decompressive craniectomy for severe traumatic brain injury.

Methods: A two-part structured interview was used to assess healthcare workers’ opinion regarding acceptable outcome in a number of hypothetical clinical scenarios. A visual analogue scale was used to assess the strength of their opinions both before and after being shown objective outcome data. Opinions were assessed in a number of scenarios, one of which was that the participants themselves were the injured party. The implication, which was clearly stated, was whether they would provide consent based on the acceptability or otherwise from the most likely outcome.

Results: Five hundred healthcare workers participated. Participants were relatively risk averse especially when the injury was severe and there was high probability of survival with severe disability. This finding was not however universal and there were a minority of participants that would provide consent even when the possibility of survival with severe disability was very high.

Conclusions: Considering consent in patients who are unable to express their wishes will always present ethical difficulties. We propose a model of consent based on a balance of the various factors that an individual may consider when a consent is provided. These include the willingness to accept survival with severe disability and how much an individual may want to risk the possibility of an unacceptable outcome in order to achieve an acceptable outcome.

Keywords: Neurotrauma, Ethics
REVISITING THE FUTILITY DEBATE IN NEUROCRITICAL CARE

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Background/Purpose: Whilst the concept of futility has been debated for many years, a precise definition remains elusive. This is not entirely unsurprising given the increasingly complex and evolving nature of modern medicine. Progressively more complex decisions are required when considering with increasingly sophisticated diagnostic and therapeutic interventions. Appropriate allocation of resources amongst a population with increasing expectations raises a number of ethical issues, especially when it comes to withholding life preserving treatment.

Methods: In this ethical discussion we have used decompressive craniectomy for severe traumatic brain injury as a clinical example with which to frame an approach to the concept. We have defined those issues that initially lead us to consider futility and thereafter actually provoke a significant discussion.

Results: We contend that these issues have uncertainty, conflict and consent. By using recent scientific advances in outcome prediction, some of the uncertainty can be demonstrated clearly and this may help stakeholders to achieve agreements and have consensus.

Conclusions: Whilst we do not anticipate that this re-framing of the idea of futility is applicable to all medical situations, the approach to specify patient-centred benefit may assist those making such decisions when patients are incompetent to participate.

Keywords: Ethics, Neurotrauma, Futility
ELDERLY MORTALITY IN PORTUGUESE ICU- AN 11 YEARS SURVEY

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Background/Purpose: The elderly population is growing and due to co morbidities, frailty and disability, the risk of poor outcomes after Intensive Care Unit (ICU) admission, has been increased. This study is to analyze the changes in Portuguese ICUs mortality of patients older than 65-years-old for 11 years

Methods: We performed retrospective cohort study of elderly admissions, in public mainland Portuguese ICUs, for eleven years: from 2000 to 2010. The sample has been divided into 2 age groups: 65-74 years, and 75 and above. Primary endpoints were to analyse the elderly ICU admission and mortality.

Results: elderly patients admitted in Portuguese ICUs during the eleven years were 61166: 28893 (47,2%) in the 65-74 years age group and 32273 (52,8%) in the 75 years and above. 35062 of the patients (57,3%) were men. The number of admissions in the 65-74 years group, has an increase of 25% (2097 patients in 2000 and 2637 in 2010), and in group of 75 and above the increase was of 90% (1837 patients in 2000 and 3491 in 2010). In-Hospital mortality on the overall was 50,8%: 45,7% in the 65-74 years group and 55,3% on 75 years and above age group. Over the years, in-hospital mortality has a reduction in both groups, in the 65-74 years group has passed of 48,8% to 46,1%, and in the group of 75 and above 59,7% to 55%.

Conclusions: The number of elderly patients in ICU has increased, but the global mortality has a slight decrease. We can conclude that age per se is not predictive of poor prognosis for ICU patients.

Keywords: Elderly, Mortality, ICU, Clinical ethics
INTER-FIELD AGREEMENT AMONG INTENSIVE CARE UNITS MEDICAL DIRECTORS AND CLINICAL ETHICS CONSULTANTS CONCERNING END-OF-LIFE DECISION MAKING IN TEXAS MEDICAL CENTER

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Background/Purpose: To assess end-of-life (EOL) practice consensus between ethics consultants and medical directors in intensive care units (ICUs) within the 21 institutions in the Texas Medical Center (TMC).

Methods: Following Institutional Review Board approval, we conducted a cross-sectional web-based survey to assess a consensus estimate of inter-field agreement among TMC ethics consultants and medical directors. Consensus was defined as ≥ 80% agreement.

Results: The study response rate was 55%. Fourteen survey items generated >80% agreement. Greatest consensus (96%) was present in a number of key areas such as the impermissibility of age being utilized as the sole factor in determining EOL treatment options and timing of EOL discussions within 24-48 hours upon a patient’s admission to the ICU. When patients are not expected to survive more than a few days, 90% of respondents agreed that it was appropriate to withdraw life-support. In contrast, 14 questions revealed <79% consensus. No agreement was found in institutional practices; this illustrates the diversity of site-specific behavior. Respondents indicated that there is great variation in the utilization of formal meetings to determine EOL care decisions. The lowest agreement was about the integration of nurses in EOL decisions.

Conclusions: Key areas of inter-field agreement and disagreement exist among TMC ICU medical directors and ethics consultants in terms of decision making at the EOL. Future research can utilize the areas of greater and lower consensus to inform studies calibrated to finely assess the professional, environmental, and personal factors that contribute to the current EOL medical decision differences.

Keywords: End-of-Life, ICU, Consensus, Decision making
LIMITATION OF THE THERAPEUTIC EFFORT IN ICU: ATTITUDE OF MULTIDISCIPLINARY TEAM ABOUT NUTRITION AND HYDRATION

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Background/Purpose: Limitation of therapeutic effort (LTE) includes withholding or withdrawing treatment however supplementing nutrition and hydration remains a controversial issue. To know the opinions of ICU team on maintaining nutritional support and hydration once LTE is decided.

Methods: We performed Prospective, cross-sectional, observational study through an anonymous, self-administered survey. The study protocol was implemented in Intensive Care unit, 20 beds, Public Hospital with 400 beds, in Buenos Aires, Argentina. Demographics data and opinion variables were investigated. Statistical analysis was performed by frequency distribution.

Results: Eighty-four ICU team members were included, 46% were younger than 35 years, 60% female, 46% physicians, 30% nurses and 24% nutritionists, pharmacists and physiotherapists. 74% had religious belief., Within opinion variables, 50% of respondents considered hydration(H) and enteral nutrition (EN) as medical treatment and comfort measure, only 3% included parenteral nutrition(PN), as measure of comfort. 83% believed LTE patients should receive hydration. When patient was receiving EN, 33% decided to continue and 33% said that this decision should be taken both by the family agreement and treating physician. Only 1% of them believed it should be continued parenteral nutrition (PN). 60% of respondents thought the patients suffered hunger and thirst, but 51% of them had not guilty feelings and 12% did not reply these s. questions.

Conclusions: 50% of ICU professionals refused to include H and EN in life support measures, while 60% thought the patients suffered hunger and thirst. Only 4% said H and EN should be removed in all cases of LTE and 51% had not guilty feelings.

Keywords: LTE, Nutritional support, Hydration
ANALYSIS OF THE CARING RESEARCH IN THE MOUTH CARE

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Background/Purpose: Outcomes of the mouth care have been mainly documented in terms of the sanitary conditions in the patients’ mouth, the eating function and the general condition. Feeding behavior is critical to the mental and social demand with other intimate person. The caring theory should be a concept covering the both behavior, then we investigate it bibliographically.

Methods: Data were referred to keywords by PubMed and MEDLINE and conducted content analysis. Caring, oral (mouth) care, geriatric, satisfaction, dysphasia, oral feeding support, caregivers, and oral health were used to search.

Results: There were many articles which took up caring as an outcome in the paper for the end of life. One was searched with the combination of mouth care and caring. The care to premature babies with a suckling disorder and their families was stated to the article (Shieh SJ, 2012). Four articles were searched with caring, geriatric, and oral feeding support, neither of these articles analyzed caring quantitatively. Four articles were searched with caring, oral health, and caregivers. The caring was verified quantitatively in one article (Mac Giolla Phadraig C, 2013) including the effect of the mouth care education to the care personnel at a nursing home.

Conclusions: It was few although there was no research proved the relation between a mouth care and caring.

Keywords: Caring, Mouth care, Caregivers
ASSOCIATION OF EARLY EMERGENCY CALLS BEFORE PATIENT COLLAPSE WITH SURVIVAL FROM OUT-OF-HOSPITAL CARDIAC ARRESTS

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Background/Purpose: Some out-of-hospital cardiac arrests (OHCAs) are witnessed or confirmed after emergency calls. This study aimed to confirm the benefit of early emergency calls before patient collapse on survival after OHCAs witnessed by bystanders and/or emergency medical technicians (EMTs).

Methods: We analysed 278,310 witnessed OHCAs [EMT-witnessed cases (n = 54,172), bystander-witnessed cases (n = 224,138)] without pre-hospital physician involvement from all Japanese OHCA data prospectively collected between 2006 and 2012. The data were analysed for the association of neurologically favourable one-month survival with the time interval between the emergency call and patient collapse.

Results: When emergency calls were placed earlier before patient collapse, the proportion of EMT-witnessed cases and survival rate after OHCAs witnessed by bystanders and EMTs were higher. When analysed only for bystander-witnessed cases, for earlier emergency calls placed before patient collapse, survival rate and incidences of bystander cardiopulmonary resuscitation (CPR) and dispatcher-assisted CPR decreased: 2.9%, 33.6% and 24.4%, respectively, for emergency calls placed >6min before collapse and 5.5%, 48.8% and 48.5%, respectively, for those placed 1-2min after collapse. Multivariable logistic regression in bystander-witnessed OHCAs with emergency calls before collapse showed that call-to-collapse interval (adjusted odds ratio; 95% confidence interval) (0.92; 0.90-0.94) and EMT response time after collapse (0.84; 0.82-0.86) were associated with survival after bystander-witnessed OHCAs with emergency calls before collapse.

Conclusions: Early emergency calls before patient collapse efficiently increases the proportion of EMT-witnessed cases and promotes survival after witnessed OHCAs. However, early emergency call before collapse may worsen the outcome when the patient’s condition deteriorates to cardiac arrest before EMT arrival.

Keywords: Out-of-hospital cardiac arrest, Cardiopulmonary resuscitation
COMPONENT ANALYSES FOR EFFECTIVENESS OF COMPRESSIONS AND VENTILATIONS IN Bystander CARDIOPULMONARY RESUSCITATION

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Background/Purpose: Emergency medical technicians (EMTs) report the case of out-of-hospital cardiac arrest (OHCA), in which bystanders have performed ventilation-only cardiopulmonary resuscitation (CPR) in victims of EMT-confirmed OHCA. This study aimed to determine the effectiveness of compression and ventilation components in bystander cardiopulmonary resuscitation (BCPR).

Methods: From out-of-hospital cardiac arrest (OHCA) data prospectively collected from 2005 to 2011 in Japan, we extracted data for 210,134 bystander-witnessed OHCA with complete datasets but no prehospital involvement of physician [no BCPR, 115,733; ventilation-only, 2,093; compression-only, 61,075; and conventional (compressions + ventilations) BCPR, 31,233] and performed component analyses of ventilations and compressions for 1-month neurologically favorable survival using simple multinominal and multivariable logistic regression analyses.

Results: The rate of survival in the no BCPR, ventilation-only, compression-only and conventional group was 2.8%, 3.9%, 4.5% and 5.0%, respectively. The unadjusted OR (95% CI) for survival after dividing BCPR into ventilation and compression components were 1.13 (1.06-1.20) and 1.64 (1.56-1.72), respectively. When adjusted by other factors known to be associated with survival, the adjusted OR (95% CI) were 1.19 (1.11-1.27) and 1.60 (1.51-1.69), respectively. The adjusted OR of ventilation component (1.38; 1.19-1.59) was as high as compression component (1.31; 1.17-1.47) in the OHCA subgroup of non-cardiac etiology, and very high in the pediatric (Age<20) OHCA subgroup (1.56; 1.13-2.15).

Conclusions: Ventilation is a significant component of BCPR, particularly when the etiology is non-cardiac and when the victims are children and adolescents. However, ventilation alone is less effective than compression in improving neurologically favourable survival after OHCA.

Keywords: Cardiopulmonary resuscitation, Out-of-hospital cardiac arrest
JPN GUIDELINES FOR THE MANAGEMENT OF ACUTE ABDOMEN 2015

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Background/Purpose: There have not been the practical guidelines for the management of acute abdomen in the world. Therefore, The Japanese Society for Abdominal Emergency Medicine and collaborated four other Societies began to make the practical guidelines for the management of acute abdomen (JPN guidelines for acute abdomen) in 2012 and finally published them in 2015. Here we present brief summary of them.

Methods: The working group of JPN guidelines consists of 18 specialists, primary care physicians, surgeons, gastroenterologists, radiologists, vascular surgeon, obstetrician & gynecologist and epidemiologists. The guidelines were made using EBM methods with level of evidence (body of evidence) and recommendations.

Results: JPN guidelines for acute abdomen 2015 contain 108 clinical questions and major topics as described below, 1) Definitions 2) Epidemiology 3) Practical algorithms of acute abdomen and tables of pain location and disease 4) History taking 5) Medical examination 6) Laboratory and radiological examination 7) Differential diagnosis 8) Initial treatment 9) Educational program. For algorithm of initial treatment for acute abdomen, 2 steps method were proposed (Fig.).

Conclusions: Since these brand-new JPN guidelines for acute abdomen 2015 is first guidelines, these need a lot of up date to be in line with a clinic in near future.

Keywords: Acute abdomen, Guidelines, Algorithms
REVISED JPN GUIDELINES FOR THE MANAGEMENT OF ACUTE PANCREATITIS: JPN GUIDELINES 2015

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Background/Purpose: JPN Guidelines for the management of acute pancreatitis was published in 2003 and revised in 2007, 2009 that the severity assessment score has been highly regarded all over the world. Since the classification and the definition of acute pancreatitis had been changed significantly in the New Atlanta classification of acute pancreatitis 2012, the working group of JPN guidelines revised JPN guidelines with making new meta-analysis and using the GRADE system.

Methods: The working group of revising JPN guidelines consists of 28 specialists, surgeons, gastroenterologists, endoscopists, radiologists, and epidemiologists.

Results: JPN guidelines 2015 contain major topics as described below, 1) Epidemiology & Etiology, 2) Diagnostic criteria, 3) Severity scoring system, 4) Fundamental and Intensive care with flowcharts, 5) Therapeutic intervention and surgery, 6) Post ERCP pancreatitis, 7) Treatment strategy, 8) Clinical Indicator and Pancreatitis Bundles, and 9) Imaging. JPN guidelines also released mobile applications for the management of acute pancreatitis. Meta-analyses were performed about prophylactic antibiotics use for the prevention of necrotizing pancreatitis & reducing mortality, in addition about prophylactic pancreatic stent placement for the prevention of Post-ERCP pancreatitis. These meta-analysis data have the results that significant effects are expected to each setting. JPN guidelines 2015 take advantage of these brand-new evidence for the new idea for the treatment of acute pancreatitis.

Conclusions: Revised JPN guidelines 2015 achieve further evolution with new meta-analysis data and contain a lot of recommendations using the GRADE system for clinical use.

Keywords: Acute pancreatitis, Guidelines, Pancreatitis bundles
**PROGNOSTIC SIGNIFICANCE OF HYPOVENTILATION INDEX ADJUSTING FOR THE SEVERITY OF METABOLIC ACIDOSIS**

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**Background/Purpose:** Current guidelines recommend a narrow target PaCO2 range of 40-45mmHg after ROSC. However, normal physiologic response to metabolic acidosis is respiratory compensation, and its loss can lead to uncompensated acidosis. We developed and tested a new hyper/hypoventilation index adjusting for the severity of metabolic acidosis.

**Methods:** This is a retrospective study of OHCA patients who survived more than 24 hours after ROSC. ECPR patients were excluded. Utstein elements and ABGA results during the first 24 hours after sustained ROSC were collected. Target PaCO2 to achieve pH of 7.4 were calculated using Henderson-Hasselbalch equation. The differences between actual PaCO2 level and target PaCO2 level were plotted against time interval between sustained ROSC and blood drawings. The AUC above X-axis was defined as relative hypoventilation index and the AUC under X-axis was defined as relative hyperventilation index. Absolute hypo/hyperventilation and hypo/hyperoxygenation index were also calculated using fixed target PaCO2 (40mmHg) and PaO2 (80mmHg) level, respectively.

**Results:** 201 patients were included. Univariable logistic regression showed that both relative and absolute hypoventilation index were significantly associated with long term (6-month) survival and neurologic outcomes. However, there were significant difference in AUROC for prediction of long-term survival (0.67 vs 0.57, respectively, p=0.002) and good neurologic outcome (0.68 vs 0.56, respectively, p<0.001). After adjustment with Utstein element variables and arterial HCO3 level, it showed significant (p=0.029) association with long-term survival, but not with neurologic outcome (p=0.087).

**Conclusions:** Relative hypoventilation index adjusting for the severity of metabolic acidosis was closely associated with long term outcomes and was an independent predictor for long-term survival.

Keywords: Cardiac arrest, Prognosis, Oxygenation, Ventilation
METHYLENE BLUE HAS A BENEFICIAL EFFECT TO PROLONGED CARDIAC ARREST IN RAT MODEL

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Seoul National University Bundang Hospital, Republic of Korea

Background/Purpose: Global ischemia associated with cardiac arrest stimulates nitric oxide (NO) and oxygen radicals production. Methylene blue (MB) can inhibit formation of NO and oxygen radicals by serving as electron carrier. This study aimed to evaluate the effect of MB in asphyxial cardiac arrest in rat model according to arrest time.

Methods: Fifty-five anesthetized male Sprague-Dawley rats were subjected to asphyxial arrest and allocated to arrest time (7.5-minute, n = 17; 9-minute, n = 18; 12-minute, n = 20). Rats received cardiopulmonary resuscitation (CPR) with either MB (2 mg/kg bolus followed by 3 mg/kg infusion over 3 hours, intravenously) or saline administration. After return of spontaneous circulation (ROSC), rats were observed for 6 hours and weaned from ventilator. Neurological deficit scores (NDS) every 24 hours after ROSC for 3 days and 7-day mortality were recorded. Survival analysis were performed using Kaplan-Meier survival curve with log-rank test. 7-day mortalities and NDSs were compared by Student t-test.

Results: There were no significant differences in baseline values among the experimental groups. 7-day mortality have a tendency to increase as arrest time prolonged, however, it was significant only in comparing 7.5-minute and 12-minute arrest (p < 0.05). In addition, mortality was lower in groups with MB infusion than with saline infusion (p < 0.05 in 9-minute and 12-minute arrest). Test for trend showed this tendency was more prominent as arrest was prolonged. NDSs were not different among the groups.

Conclusions: MB has a beneficial effect in improving survival rates in asphyxial cardiac arrest, and is more efficient in prolonged arrest.

Keywords: Methylene blue, Cardiac arrest, Nitric oxide, Asphyxia
### Oral Presentation

539 12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

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<td>71.3 ± 10.2</td>
<td>68.6 ± 10.7</td>
<td>68.9 ± 10.4</td>
</tr>
<tr>
<td>HCO3 (mEq/L)</td>
<td>19.2 ± 2.6</td>
<td>22.7 ± 3.0</td>
<td>21.0 ± 2.9</td>
<td>20.3 ± 3.4</td>
</tr>
<tr>
<td>Base excess</td>
<td>-5.8 ± 2.6</td>
<td>-2.3 ± 3.3</td>
<td>-4.1 ± 2.8</td>
<td>-4.7 ± 3.4</td>
</tr>
<tr>
<td>Lactate (mmol/L)</td>
<td>0.65 ± 0.18</td>
<td>1.01 ± 0.18</td>
<td>0.94 ± 0.27</td>
<td>0.89 ± 0.23</td>
</tr>
<tr>
<td>Mean arterial pressure (mmHg)</td>
<td>87.8 ± 12.9</td>
<td>96.2 ± 28.3</td>
<td>91.6 ± 12.4</td>
<td>84.3 ± 10.3</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>293.8 ± 24.2</td>
<td>299.1 ± 13.1</td>
<td>298.7 ± 25.7</td>
<td>300.9 ± 17.3</td>
</tr>
<tr>
<td>Body temperature (°C)</td>
<td>36.84 ± 0.42</td>
<td>36.90 ± 0.41</td>
<td>36.42 ± 0.27</td>
<td>36.49 ± 0.33</td>
</tr>
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</table>

### Cardiac arrest & Cardiopulmonary resuscitation

|                                    |                   |                |                   |       |                   |           |       |
|                                    | Induction time    | CPR duration    | Total ischemia    |                 | Lactate after ROSC |               |       |
|                                    |                   | (seconds)       | time (seconds)    |                 | (mmol/L)           |               |       |
|                                    | 65.2 ± 10.0       | 95.3 ± 11.8     | 545.3 ± 11.8      | 6.21 ± 1.13     | 36.84 ± 0.42       | 0.02       |
|                                    | 63.5 ± 8.6        | 94.5 ± 12.6     | 544.5 ± 12.6      | 6.73 ± 1.44     | 36.90 ± 0.41       | 0.00       |
|                                    | 60.7 ± 7.0        | 102.5 ± 17.4    | 642.5 ± 17.4      | 7.74 ± 1.92     | 36.42 ± 0.27       | 0.03       |
|                                    | 62.4 ± 10.8       | 99.9 ± 14.6     | 639.8 ± 14.6      | 8.13 ± 2.49     | 36.49 ± 0.33       | 0.00       |
|                                    | 65.3 ± 11.9       | 129.8 ± 33.6    | 849.8 ± 33.6      | 9.00 ± 0.84     | 36.46 ± 0.26       | 0.00       |
|                                    | 58.3 ± 10.2       | 115.6 ± 19.1    | 835.6 ± 19.1      | 9.33 ± 2.81     | 36.54 ± 0.24       | 0.00       |

### 6-hour post-resuscitation care

|                                    |                   |                |                   |       |                   |           |       |
|                                    | pH                | PaCO2 (mmHg)   | PaO2 (mmHg)       | HCO3- (mEq/L) | Base excess       | Lactate (mmol/L) | Mean arterial pressure (mmHg) | Heart rate (bpm) |
|                                    | 7.38 ± 0.04       | 29.3 ± 8.9     | 68.7 ± 55.8      | 17.3 ± 2.4     | -8.1 ± 2.2        | 0.83 ± 0.20 | 224.6 ± 13.4                 | 324.0 ± 19.4     |
|                                    | 7.41 ± 0.04       | 27.8 ± 3.3     | 64.9 ± 7.1       | 18.0 ± 2.9     | -6.9 ± 3.4        | 1.03 ± 0.41 | 98.7 ± 11.3                  | 341.7 ± 0.6     |
|                                    | 7.38 ± 0.05       | 27.1 ± 4.7     | 62.1 ± 19.3      | 16.2 ± 1.4     | -6.1 ± 1.4        | 0.90 ± 0.51 | 102.3 ± 13.7                 | 296.5 ± 17.7     |
|                                    | 7.41 ± 0.02       | 28.3 ± 4.1     | 70.0 ± 16.9      | 18.0 ± 2.0     | -7.0 ± 1.9        | 0.67 ± 0.18 | 94.3 ± 5.7                   | 312.0 ± 1.4     |
|                                    | 7.21 ± 0.05       | 28.3 ± 4.1     | 123.0 ± 136.0    | 17.8 ± 1.3     | -10.3 ± 1.2       | 1.80 ± 0.13 | 73.0 ± 33.8                  | 272.7 ± 1.2     |
|                                    | 7.30 ± 0.03       | 34.3 ± 6.3     | 42.1 ± 2.6       | 16.9 ± 3.2     | -9.8 ± 3.3        | 1.17 ± 0.58 | 74.3 ± 30.0                  | 294.0 ± 16.4    |

### Graph

<Graph>
ULINASTATIN PROTECT THE HYPOTHALAMUS-PITUITARY-ADRENAL AXIS IN SEPTIC RATS VIA DIFFERENTIAL EXPRESSIONS OF NNOS AND INOS IN THE HYPOTHALAMUS

Zhang Yu Xiang, Wang Yu, Zheng Yang

Department of ICU, 309 Hospital PLA, China

Background/Purpose: In the present study, the expressions of neuronal and inducible isoform of NOS (nNOS and iNOS) were observed in the septic rats experienced Ulinastatin treatment, thereby the effects of NO in the (HPA) axis were investigated and the mechanism was inferred.

Methods: Sepsis was induced in adult male Wistar rats by cecal ligation and puncture (CLP). 40 rats were randomly divided into the control group, sham-operated group, saline treatment group, Ulinastatin injection treatment group (UTI group, 100,000U/kg). RT-PCR was used to detect the expression of CRH and iNOS/nNOS and Fos mRNA. Western blot was used to detect the expression of CRH and iNOS/nNOS and Fos protein. Radioimmunoassay was used to detect the levels of the ACTH and CORT in the plasma.

Results: Compared with the normal control group or sham group, the levels of CRH in hypothalamus tissue and the ACTH, CORT level in plasma were increased in the early stage of sepsis. In UTI group, CRH, ACTH, CORT concentrations were significantly lower than those in NS group. In UTI group, the expression of CRH, c-fos, iNOS mRNA and protein in hypothalamus tissue were significantly lower than those in NS group. But, the expression of nNOS mRNA and protein in the hypothalamus tissue were significantly higher than those in NS group.

Conclusions: These results suggest that the curative effect of Ulinastatin on septic rats is possibly attributable to the differential regulation of NOS/NO in the hypothalamus, leading to decreased CRH and improvement excessive activated condition of HPA axis.

Keywords: Sepsis; CLP, Hypothalamic-pituitary-adrenal axis
THE EFFECTS OF PYRIDOXAL 5-PHOSPHATE (PLP) PRETREATMENT IN CECAL LIGATION AND PUNCTURE INDUCED SEPSIS IN MICE

Jong Taek Park
Yonsei University Wonju College of Medicine, Republic of Korea

Background/Purpose: Severe sepsis is a serious medical condition, leading cause of morbidity and mortality in the intensive care unit (ICU), with vascular endothelial dysfunction, massive vasodilation and multi-organ failure. Pyridoxal 5-phosphate (PLP) is the biologically active form of vitamin B6 and acts as a cofactor of the cystathionine gamma-lyase enzyme (CSE), responsible for the production of hydrogen sulfide (H2S) in the vascular endothelium. H2S is an endothelium-derived hyperpolarizing factor that plays a role in the sulfhydration of potassium channels, which leads to vasodilation. We hypothesized that PLP decreases vascular endothelial H2S production by inhibition of CSE, hence protecting sepsis associated vascular dysfunction and reducing mortality.

Methods: Male mice were divided into two groups and subjected to CLP and treated with PLP (20mg/kg/day, 28days). We recorded Mean arterial pressure (MAP) and measured sepsis associated vitality and mortality in mice following PLP treatment. We also determined the effect of PLP on CSE activity in liver tissue.

Results: There was a significant rise in MAP in PLP pretreatment group at the end of 14 days (117.8±5.04mmHg vs. 91.80±1.03mmHg), which returned to normal by day 28. Kaplan Mayer curve demonstrated 100% mortality in control group as compared to 60% mortality in PLP pretreatment mice. In separate experiments in livers tissue, a dose dependent decrease in CSE activity was observed at a dose of 10μM PLP and higher.

Conclusions: High doses of PLP decreases CSE activity, increases MAP, and reduces mortality in CLP induced sepsis.

Keywords: Cystathionine gamma lyase enzyme (CSE), Hydrogen s
ACUTE RENAL DENERVATION DOES NOT AMELIORATE RENAL FUNCTION IN AN OVINE MODEL OF SEPTIC SHOCK

Emiel Hendrik Post, Fuhong Su, Koji Hosokawa, Fabio Silvio Taccone, Jacques Creteur, Jean-louis Vincent, Daniel de backer

Department of Intensive Care, Hopital Erasme, Universite Libre de Bruxelles, Belgium

Background/Purpose: Experimental data has suggested a beneficial effect of renal denervation in normotensive endotoxemia. We investigated the effects of acute renal denervation on general and renal hemodynamics and kidney function in an ovine model of septic shock.

Methods: 14 animals were randomized to bilateral renal denervation (n = 7; RDX) or sham procedure (n = 7; CON). After baseline measurements (T-1), surgical denervation was performed by stripping the renal artery from the adventitia and applying a 20% phenol in 95% alcohol solution. In sham animals, the adventitia was left untouched and the artery was moistened with a 0.9% NaCl-solution. Cardiac output (CO) was monitored using a pulmonary artery catheter. A flow-probe was placed around the left renal artery to measure renal blood flow (RBF). Sepsis was induced after a two-hour stabilization period by injecting 1.5g/kg of autologous feces into the abdomen (T0). The animals were observed for 18 hours and data were analyzed for interaction between group and time using linear mixed models. A p-value of less than 0.05 was considered statistically significant.

Results: There were no differences in MAP and CO between groups. RBF was initially increased in the denervation group but returned to control values within 12 hours (p < 0.001). Creatinine clearance (CCR) evolved similarly in both groups (p = 0.896), as did urine output (UO, p = 0.972) and fractional excretion of sodium (FENa, p = 0.274).

Conclusions: Acute renal denervation transiently increased RBF during sepsis but failed to prevent the deterioration in renal hemodynamics and function after shock developed.

Keywords: Sepsis, AKI, Denervation, Kidney

<table>
<thead>
<tr>
<th>Table 1: General and renal hemodynamics and kidney function</th>
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<tr>
<td><strong>T-1</strong></td>
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<tr>
<td>MAP, mmHg</td>
</tr>
<tr>
<td>CON</td>
</tr>
<tr>
<td>RDX</td>
</tr>
<tr>
<td>CO, L/min</td>
</tr>
<tr>
<td>CON</td>
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<td>RDX</td>
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<tr>
<td>CCI, mL/min</td>
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<td>RDX</td>
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<tr>
<td>FENa, %</td>
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<tr>
<td>CON</td>
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BLOCKAGE OF ARGinine VASOPRESSIN RECEPTOR 2 PREVENTS VASCULAR LEAKAGE AND REDUCES INCREASE IN PULMONARY VASCULAR RESISTANCE IN OVINE SEPSIS

Ernesto Lopez¹, Osamu Fujiwara¹, Baigalmaa Enkhtaivan¹, Satoshi Fukuda¹, Koji Ihara¹, David N Herndon², Donald S Prough¹, Perenlei Enkhbaatar¹

¹University of Texas Medical Branch, Galveston, TX, United States, ²Shriners Hospital for Children, Galveston, TX, United States

Background/Purpose: Vascular hyperpermeability and subsequent tissue edema are deleterious complications in sepsis. Arginine Vasopressin (AVP) causes vasoconstriction via its V1a receptor agonist effect. However, the role of its V2 receptor (V2R) during sepsis has been poorly studied. We hypothesized that V2R activation during pneumonia-sepsis augments vascular leakage, thus promoting cardiopulmonary collapse. We used our well-characterized highly translational ovine Methicillin-resistant Staphylococcus aureus (MRSA) sepsis model.

Methods: Sepsis was induced in 19 surgically instrumented sheep by insufflation of cooled cotton smoke (48 breaths) and instillation of MRSA (3.5X10^11CFU) into the lungs under anesthesia and analgesia. Grouping: V2R agonist desmopressin (DDAVP-832.1ng/kg, n=6,); V2R antagonist tolvaptan (TLVP-10mg/kg, n=6,); or Saline (control, n=7). Additional 6 uninjured/untreated sheep (Sham, n=6). All sheep were placed on mechanical ventilation, fluid resuscitated and monitored for 24hrs in a conscious state.

Results: TLVP significantly attenuated systemic fluid accumulation compared to Control, while desmopressin tended to augment the MRSA-induced fluid accumulation. Fluid resuscitation to hematocrit was comparable in all groups. TLVP significantly inhibited circulating brain natriuretic peptide (BNP) and reduced increases in left atrium (LAP), pulmonary artery (PAP) and lung capillary pressures (Pc), suggesting that TLVP attenuated pulmonary circulation overload and resistance by improving heart performance. DDAVP did not affect these changes. Lung water content (wet-to-dry ratio) was significantly increased in control and DDAVP vs. Sham. No difference was found between TLVP and Sham.

Conclusions: Our data strongly suggest that modulation of AVP V2R activation should be considered for treatment of septic patients as an adjunct therapy to various vasopressors. Support: GM097480, SHC84050

Keywords: Vasopressin receptor 2, Tolvaptan, Vascular hyperpermeability, Shock, Pulmonary resistance

<table>
<thead>
<tr>
<th>Group</th>
<th>Fluid Accumulation (mL)</th>
<th>Hematocrit (changes from baseline)</th>
<th>LAP (mm Hg)</th>
<th>PAP (mm Hg)</th>
<th>Pc (mm Hg)</th>
<th>BNP (changes from baseline)</th>
<th>Wet-to-dry ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>5633±2739^</td>
<td>0.94±0.05</td>
<td>17.5±1.5^</td>
<td>31.7±4.6^</td>
<td>23.2±2.2^</td>
<td>2.0±1.0^</td>
<td>7.4±0.4^</td>
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<tr>
<td>DDAVP</td>
<td>4672±1368^</td>
<td>0.96±0.06</td>
<td>17±1^</td>
<td>31.8±2.3^</td>
<td>24.2±2.1^</td>
<td>2.0±0.7^</td>
<td>6.7±0.4^</td>
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<tr>
<td>TLVP</td>
<td>983±935^</td>
<td>0.98±0.07</td>
<td>10.2±1.3^</td>
<td>21.4±0.9^</td>
<td>15.5±1.2^</td>
<td>0.6±0.2^</td>
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<tr>
<td>Sham</td>
<td>54±244</td>
<td>0.91±0.05</td>
<td>11±1.3</td>
<td>25.5±2.3</td>
<td>22±1.8</td>
<td>0.5±0.1</td>
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<Table>

* p<0.05 vs. CTRL, ^ p=0.05 vs. Sham. Mean ± SEM
EFFECTS OF LIPOPOLYSACCHARIDE ON RBC ALTERATION IN MICE ENDOTOXEMIC MODEL

Seolju Park1, Jeihak Myung3, Yeonhee Kim2, Sungmook Yoo4, Jaekwan Lim4, Choonhak Lim1

1Korea University Anam Hospital, Republic of Korea, 2Korea University Ansan Hospital, Republic of Korea, 3Korea University Medicine Graduate School, Republic of Korea, 4Korean Artificial Organ Research Center, Republic of Korea

Background/Purpose: Sepsis is a complex pathophysiological process that involves both alterations in the microcirculation (vessels with a diameter <100 m) and changes in the biochemical and physiological characteristics of the blood constituents. Alterations in RBC rheology participate in the alterations of the microcirculation. Early alterations of RBC rheology are reported to be seen commonly in the septic patients. However, time course of RBC alterations are not revealed. Therefore we evaluated the change of RBC deformability and RBC aggregation in the mice endotoxemic model using lipopolysaccharide (LPS).

Methods: Six-week-old male BALB/c mice were used in this study. The LPS-induced sepsis mice received LPS (20 mg/kg) intraperitoneally. Elongation indices (EIs) and aggregation indices (AIs) were tested at shear stresses of 1, 3, 7, 10 and 20 Pascal (Pa) for 0.5, 1, 2, 4, 6, 9, 12 and 24 hours after LPS.

Results: There were no difference in AIs on 0.5, 1, 2, 4, 6, 9, 12 and 24 hours after LPS, however, EIs significantly decreased in only 10 and 20 Pa. at 24 hours after LPS (p < 0.05).

Conclusions: Our results suggested that change of RBC deformability was revealed on 24 hours after LPS injection and choice of an appropriate shear stress may detect alterations of RBC deformability in LPS-induced sepsis mice.

Keywords: Lipopolysaccharide, RBC deformability, RBC aggregation, Shear stress
DIFFERENCES IN EXPRESSION OF THE HUMAN DIFFERENCES IN EXPRESSION OF THE HUMAN SFTPB VARIANT DETERMINE SUSCEPTIBILITY TO STAPHYLOCOCCUS AUREUS INFECTION IN LUNG

Jiao Liu¹, Zhiyong Liu¹, Osama Abdel-razek², Sara Javidiparsijani², Yunhe Xiong¹, Guirong Wang²

¹Department of Critical Care Medicine, Renmin Hospital of Wuhan University, China, ²Department of Surgery, SUNY Upstate Medical University, United States

Background/Purpose: Surfactant protein B (SP-B), a member of Saposin-like family of proteins (SAPLIP), plays roles in both lowering surface tension and antimicrobial activity in the lung. Recent studies demonstrated the patients with the C allele of SP-B gene are susceptible to bacterial pneumonia. In the study we examined the effects of the T and C alleles of human SP-B gene with humanized transgenic mice in bacterial pneumonia model.

Methods: Humanized transgenic (hTG) mice, which expressed the C or T allele of human SP-B genetic variants in a mouse SP-B (-/-) background, was generated and used in this study. Pneumonia model was induced using S. aureus (CFU: 5x10^8/mouse) intratracheal injection in hTG SP-B mice. Lung tissue and bronchoalveolar lavage fluid (BALF) were harvested 24h after exposure to S. aureus or saline (control). Histological changes were consistent with pneumonia. Cellular and molecular analyses were performed by Western blot, ELISA, CFU counts. In vivo imaging system was also used to analyze the dynamic bacterial clearance in the lung.

Results: S.aureus-treated hTG SP-B-C mice exhibited higher mortality than hTG SP-B-T mice (p<0.05). In vivo results demonstrated that infected hTG hSP-B-C mice displayed decreased bacterial clearance 24h post-infection compared to infected hTG hSP-B-T mice. Infected hTG SP-B-C mice showed more severe lung injury (p<0.05) and inflammation (p<0.01) in the lung compared to infected hTG SP-B-T mice 24 hrs after infection. The bacterial load was higher (p<0.01) in the BALF of infected hTG SP-B-C mice compared to that infected hTG SP-B-T mice. We observed the levels of surfactant phospholipid and surfactant proteins A and B in BALF, which functions lowering surface tension of alveoli in the lung, decreased significantly (p<0.01) in infected hTG SP-B-C mice, when compared with infected hTG SP-B-T mice. Moreover, infected hTG SP-B-C mice showed increased apoptotic cells and caspase-3(a biomarker of apoptosis) as well as decreased levels of Bcl-2 (an inhibitor of apoptosis) in the lung compared to infected hTG SP-B-T mice. Furthermore, levels of NF-κB P65, phosphorylated IκB-α and P38 increased significantly in the lung of infected hTG SP-B-C mice which were related with significant increased levels of IL-6 and TNF-a in BALF than infected hTG SP-B-T mice.

Conclusions: Mice with C allele or T allele of human SP-B genetic variants exhibited different susceptibility to bacterial Staphylococcal pneumonia through regulating NF-κB pathway related inflammation and apoptosis.

Keywords: Surfactant protein B, Pneumonia, Susceptibility
NIACIN AND SELENIUM ATTENUATES SEPSIS-INDUCED LUNG INJURY BY UP-REGULATING NRF2 SIGNALING

Woon Yong Kwon¹, Gil Joon Suh¹, Kyung Su Kim¹, Yoon Sun Jung², Sung Hee Kim¹

¹Seoul National University College of Medicine, Republic of Korea, ²National Medical Center, Republic of Korea

Background/Purpose: To investigate whether the combination therapy of clinically relevant doses of niacin and selenium attenuates lung injury and improves survival during sepsis in rats and to determine if its therapeutic benefits are associated with an activation of the glutathione redox cycle and up-regulation of Nrf2.

Methods: In LPS-exposed HMVEC-L cells, the dose-related effects of niacin and selenium were assessed, and then the antioxidant and anti-inflammatory effects of the combination therapy of niacin (0.9 mM) and selenium (1.5 μM) were evaluated. The role of Nrf2 in combination therapy was also determined using Nrf2 knockdown cells. In endotoxemic rats and CLP-operated male Sprague-Dawley rats, the therapeutic effects of the combination therapy of niacin (360 mg/kg) and selenium (60 μg/kg) were also evaluated.

Results: Combination therapy reduced hydrogen peroxide by the synergistic activation of the glutathione redox cycle, which involves niacin-induced increases in glutathione reductase activity and reduced glutathione level and a selenium-induced increase in glutathione peroxidase activity. Combination therapy contributed to an up-regulation of Nrf2, enhancement of glutathione synthesis, and down-regulation of NF-κB signaling, but Nrf2 knockdown inhibited the enhancement of glutathione synthesis and down-regulation of the NF-κB pathway by combination therapy. In addition, combination therapy attenuated lung injury and improved survival during sepsis in rats.

Conclusions: The combination therapy of clinically relevant doses of niacin and selenium attenuated lung injury and improved survival during sepsis. Its therapeutic benefits were associated with a synergistic activation of the glutathione redox cycle, reduction of hydrogen peroxide, up-regulation of Nrf2, and down-regulation of the NF-κB pathway.

Keywords: Sepsis, Reactive oxygen species, Glutathione, Lung
MESENCHYMAL STEM CELLS IMPROVES SURVIVAL IN A MICE MODEL OF SEVERE PNEUMOCOCCAL PNEUMONIA

Marcos I Restrepo\textsuperscript{1,2}, Luis F Reyes\textsuperscript{1,4}, Cecilia A Hinojosa\textsuperscript{1}, Dirk A Hunt\textsuperscript{3}, Alejandro Rodriguez\textsuperscript{2}, Robbie Johnson\textsuperscript{3}, Nilam Soni\textsuperscript{1,2}, Antonio Anzueto\textsuperscript{1,2}, Jay I Peters\textsuperscript{1,2}, Mary Pat Moyer\textsuperscript{3}, Carlos J Orihuela\textsuperscript{1}

\textsuperscript{1}University of Texas Health Science Center at San Antonio, United States, \textsuperscript{2}South Texas Veterans Health Care System (STVHCS), United States, \textsuperscript{3}INCELL Corporation, United States, \textsuperscript{4}Universidad de La Sabana, Colombia, \textsuperscript{5}Hospital Joan XXIII, Spain

Background/Purpose: Community acquired pneumonia is the leading cause of morbidity, and mortality worldwide. Streptococcus pneumoniae is a principal etiology of community-acquired pneumonia. Therapy with human adipose tissue-derived Mesenchymal Stem Cells (Ad-MSCs) could reduce mortality by inhibiting bacterial growth, modulating the often excessive host-immune response, and enhancing tissue repair. Limited data are available regarding the impact of Ad-MSCs in pneumococcal pneumonia. This proof-of-concept pilot study tested the hypothesis that intratracheal Ad-MSCs improves survival in a murine pneumococcal pneumonia model.

Methods: Mice were infected intranasally with 10\textsuperscript{7} colony forming units of S. pneumoniae. After 24 hours, mice with pneumonia received live, pre-labeled intratracheally delivered 10\textsuperscript{6} Ad-MSCs (n=7) vs. Control (n=8, Ad-MSCs carrying solution). Disease severity was tested by weight loss and the presence of bacteremia at 12-hour intervals. Animals were followed until they developed a moribund state. Cumulative survival analysis was performed.

Results: Ad-MSCs accumulated in the lungs as measured by tissue visualization of the pre-labeled cells. No differences among groups were observed for the lung injury score and bacterial growth. Survival analysis revealed no deaths in both groups at 12 and 24 hours periods. A larger proportion of mice survived in the Ad-MSCs group at 36 (100% vs. 75%, p=0.48), 48 (57% vs. 37%, p=0.62), and 60 hours (43% vs. 0%, p=0.08) post infection when compared to the control group.

Conclusions: There is a tendency towards higher survival among intratracheally treated mice Ad-MSCs with invasive pneumococcal pneumonia. Translation of these findings to other species including humans may improve the survival due to invasive pneumococcal pneumonia.

Keywords: Pneumonia, Sepsis, Stem Cells
EP2 GENE-MODIFIED MESENCHYMAL STEM CELLS ENHANCE MIGRATION TO INJURED LUNG TISSUE AND FURTHER ATTENUATE LIPOPOLYSACCHARIDE-INDUCED LUNG INJURY IN MICE

Jibin Han, Xiaomin Lu, Lijuan Zou, Hongli He, Qihong Chen, Jingyuan Xu, Yi Yang, Haibo Qiu

Department of Critical Care Medicine, Zhongda Hospital, Southeast University School of Medicine, China

Background/Purpose: It is presumed that enhance MSCs homing to target tissues could achieve better therapeutic effect through releasing paracrine factors within target tissues. Prostaglandin E2 (PGE2) biosynthesis is significantly increased in inflamed tissue. In addition, PGE2 has been proved to facilitate MSCs migration through activation of EP2 receptor in vitro.

Methods: C57BL/6 mice were intratracheal instilled with LPS to induce lung injury. Four hours after LPS challenge, mice were administered with PBS, MSC expressing reporter GFP (MSC-GFP group), and MSC expressing EP2 (MSC-EP2 group) (5 × 10^5 cells resuspended in 100 ul PBS) via tail vein injection. MSC homing to lung tissue was observed by near infrared imaging and Fluorescence microscopy respectively, at 24 hours and 72 hours after transplantation. Pulmonary vascular permeability was assessed by lung wet/body weight ratio and Evans blue assay. Inflammatory cytokine levels were measured by ELISA.

Results: Near infrared imaging shown that administration of MSC-EP2 significantly enhance MSC homing to injured lung tissue compared to that of MSC-GFP group (P<0.05). Immunofluorescence evaluation of engrafted MSC in lung tissue also observed a similar trend. MSC-EP2 also further reduced LPS-induced pulmonary vascular permeability as reflected by reducing levels of Evans blue in lung parenchymal homogenates compared to that of MSC-GFP group (P<0.05). Furthermore, administration of MSCs-EP2 decreased IL-1β and TNF-α levels to a greater extent than did the MSC-GFP group at both 24 and 72 hours (P<0.05).

Conclusions: EP2-modified MSCs significantly enhance MSCs homing to injured lung tissue and bring additional improvement in terms of lung inflammation and permeability.

Keywords: ARDS, MSC, Homing, PGE2, EP2 receptor
EFFECTS OF LOW TIDAL VOLUME VENTILATION IN A MURINE MODEL OF VENTILATOR-INDUCED DIAPHRAGMATIC DYSFUNCTION

Hwa Jin Cho¹, Seongwoo Kang², Sukhan Jeong², Hyunwoo Kim², Do Hyeon Yu², In Seok Jeong¹
¹Chonnam National University Hospital, Republic of Korea, ²Chonnam National University, College of Veterinary Medicine, Republic of Korea

Background/Purpose: Mechanical ventilation (MV) is one the most important treatment in patients who are unable to have adequate pulmonary gas exchange to attain sufficient alveolar ventilation. The aims of this study were first to establish VIDD model in murine model and second to evaluate the effects of low tidal volume ventilation by exploring both histologic and the main protease pathway after MV.

Methods: Healthy male C57/BL6 mice (10-12 weeks, 25-30g) were randomly divided to experimental groups: 1) High tidal volume MV for 8 h (HTV group, n=6), 2) low tidal volume MV for 8 h (LTV group, n=6), and 3) controls (Control group, n=6). Arterial blood gas analysis, diaphragmatic contractile properties, histologic evaluation, measurements of cytokines (IL-1beta, IL-6, IL-10 and TNF-alpha) and biochemical evaluation for main proteolysis pathways were done in all three groups.

Results: Arterial blood gas analyses were comparable between groups and were within normal ranges. Diaphragmatic force production declined in high tidal volume ventilation compared to the control and low tidal volume ventilation group. Diaphragmatic force production in low tidal volume ventilation was higher than that of high tidal volume ventilation but slightly declined compared to control group.

Conclusions: Low tidal volume ventilation partially attenuates the ventilator induced diaphragmatic dysfunction.

Keywords: Ventilator-induced diaphragmatic dysfunction
EARLY WARNING OF MEMBRANE THICKNESS INCREASE THROUGH DIFFUSING CAPACITY FOR CARBON MONOXIDE

Min-yeong Kang, Bernard Sapoval

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Background/Purpose: It was recently shown that respiration at rest benefits from a large reserve due to very rapid oxygen saturation. When a pathologic augmentation of the alveolar-capillary membrane thickness occurs, the saturation slows down. This augmentation has no effect on the oxygen capture (VO2) up to a critical threshold where the time for capture exceeds the capillary transit time. But no such reserve exists for the capture of carbon monoxide (CO) so that the diffusing capacity for CO (DLCO) is sensitive to any modification of the membrane thickness.

Methods: We proposed a new quantitative theory of DLCO based on the comparison between the diffusion time needed to reach haemoglobin molecules from the alveolar gas and the reaction time with haemoglobin.

Results: The blue curve shows that VO2 remains constant until the thickness of the membrane increases up to about 3 to 4 um (Figure). On the contrary, DLCO is directly sensitive to such thickness increase.

Conclusions: DLCO gives an early warning of an abnormal increase in alveolar-capillary membrane thickness which might appear in early stage of pulmonary edema and interstitial diseases with no symptoms in oxygen capture.

Keywords: DLCO, Pulmonary edema, Interstitial disease, Respiratory reserve
HIGH CORTISOL LEVELS ARE ASSOCIATED WITH BRAIN DYSFUNCTION BUT LOW PROLACTIN CORTISOL RATIO LEVELS ARE ASSOCIATED WITH NOSOCOMIAL INFECTION IN SEVERE SEPSIS

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Background/Purpose: To investigate the impact of cortisol and prolactin levels on brain dysfunction and on the incidence of nosocomial infection in patients with severe sepsis and septic shock.

Methods: Brain dysfunction including delirium and coma was diagnosed by the Richmond Agitation Sedation Scale (RASS) and the Confusion Method Assessment in the ICU (CAM-ICU) 24 hours after sedation withdrawal. Serum cortisol and prolactin levels were simultaneously measured within 6 hours after ICU admission and daily over the first four days.

Results: Brain dysfunction was developed in 84% (107/127) of patients. Nosocomial infection was developed in 76% (62/82) of patients with brain dysfunction. High cortisol levels (p= 0.007) were independently associated with brain dysfunction regardless coma or delirium (OR: 1.92, 95% CI (1.32, 2.71), p= 0.021). Low prolactin levels (p= 0.016), and lower prolactin/cortisol ratio (p= 0.01) were independently associated with the development of nosocomial infection in patients with brain dysfunction (OR: 1.15, 95% CI (1.25, 1.89)).

Conclusions: High cortisol levels are associated with the development of brain dysfunction but low prolactin/cortisol ratio levels are associated with higher risk of development of nosocomial infection in patients with severe sepsis and septic shock.

Keywords: Cortisol, Prolactin, Brain dysfunction, Nosocomial infection, Sepsis
INCREASED IMMATURE PLATELET FRACTION PRIOR TO PLATELET COUNT DECLINE REFLECTS INCREASED PLATELET PRODUCTION AND COAGULOPATHY-RELATED PLATELET CONSUMPTION IN PATIENTS WITH SEPSIS

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Background/Purpose: Mechanisms of increased immature platelet fraction (IPF) and its diagnostic values in sepsis are not determined. The objective of this study was to evaluate IPF for association with subsequent decrease in platelet count (PC), and coagulopathy in patients with sepsis.

Methods: Adult septic patients admitted to the ICU were prospectively included. We measured IPF in eligible patients with PC ≥80×10³/μL on ICU admission, and followed for development of subsequent PC decline (>30% decrease or <80×10³/μL within 5 days). Absolute immature platelet count (AIPC) was calculated as actual number of immature platelets for evaluation of thrombopoiesis, and disseminated intravascular coagulation (DIC) scores were daily recorded.

Results: One-hundred and two patients with sepsis and 49 without sepsis (controls) were enrolled. Forty-six septic patients developed subsequent decrease in PC. IPF was highest in patients with decrease in PC, and higher in patients without decrease in PC compared to controls [median, 2.1 (1.6-3.6) vs. 3.7 (2.7-4.7) vs. 4.4 (3.1-8.1), respectively; p<0.0001]. AIPC was elevated in patients with and without PC decline compared to controls [0.41 (0.29-0.63) vs. 0.58 (0.41-0.87) vs. 0.81 (0.43-1.01), respectively, p=0.0001], however no difference was observed between patients with and without PC decline. Univariate analysis showed significant relationship between coagulation abnormalities and subsequent decrease in PC. Multiple regression analysis demonstrated that IPF was a significant predictor of maximum DIC scores (p=0.04).

Conclusions: IPF was elevated with increased platelet production in early phase of sepsis. Further increase of IPF may indicate ongoing platelet consumption and be a predictive marker for PC decline in patients with septic coagulopathy.

Keywords: Immature platelet fraction, Sepsis, Coagulopathy, DIC, Thrombocytopenia
THROMBOELASTOGRAPHY EVALUATION FOR HEMOSTATIC DYSFUNCTION IN SEVERE SEPSIS AND SEPTIC SHOCK: AN EXPERIENCE FROM TERTIARY CARE CENTRE IN NORTH INDIA

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Background/Purpose: Sepsis induced coagulopathy manifests either as a procoagulant state or as a hypo-coagulant state. Conventional coagulation assays (CCA) are unable to differentiate between these states. Thromboelastography (TEG) has emerged as a better diagnostic modality by providing complete dynamics in hemostatic disorder. We evaluated hemostatic dysfunction in sepsis by TEG.

Methods: This is a prospective, observational study done in a 12-bedded ICU at a tertiary care teaching hospital, during May 2014- Dec 2014. After ethical clearance, all consecutive patients at ICU admission with presence of either severe sepsis or septic shock, were considered for inclusion. Exclusion criteria were: age <18 yrs, haematological malignancy, history of medical condition with deranged coagulation, plasma and/or platelet transfusion in current illness, or on oral anti-platelet/ anti-coagulant. For TEG, 3.0 ml blood was collected in citrate vial during 24 hr of ICU admission. A kaolin-based thromboelastograph analyzer (TEG Hemoscope 5000) was used; and parameters were recorded: reaction time (R), K time (K), alpha angle (α), maximum amplitude (MA), coagulation index (CI), lysis index (LY 30%). Other collected data were: demographic, clinical, routine laboratory including CCA at ICU admission; and outcome at ICU discharge. Continuous variables are presented as mean (±SD); and categorical as frequency (%). Comparison between groups was done by Students t-test and Chi-square test.

Results: During study, 104 patients got admitted; 87 patients had severe sepsis/septic shock. As per inclusion criteria, 55 patients (27 severe sepsis/ 28 septic shock) were analyzed. Mean age 45.6±17 yrs, male 62%, medical 76%, co-morbidities 60%. Primary source of infection was lung in 24%, followed by CNS (15%), UTI (7%), and tropical illness (7%). Mean APACHE II was 21.14±7.01; and SOFA score 12.57±3.19. Among CCA, mean values for PT, INR, platelet and fibrinogen were: 18.04±4.83 (sec), 1.63±0.57, 153.96±99.16 (×103/mm3), and 301.33±112.82 (mg/dl) respectively. In TEG, mean values of R, K, α, MA, CI, LY30 parameters were: 6.45±2.59 (min), 1.67±0.96 (min), 66.37±10.44 (0), 67.08±10.33 (mm), 0.63±3.46, 2.23±4.08 (%) respectively. In septic shock vs severe sepsis groups, mean R, K, alpha angle, MA, CI, LY30 were: 6.77±2.79 vs 6.06±2.29 (p=0.31) , 1.87± 0.86 vs 1.43±0.99 (p=0.08), 63.85±9.78 vs 69.29±10.22 (p=0.048), 63.55±11.39 vs 70.86 7.12 (p=0.006), -0.29±3.48 vs 1.65±3.14 (p=0.038), 2.79± 5.29 vs 1.49±1.93 (p=0.24) respectively. In follow up, median length of stay was 13.5 (2-60) days; and 55% patients survived.

Conclusions: TEG can differentiate between hypocoagulant, procoagulant and normal state, which is useful in diagnosis and management of hemostatic abnormalities. In our study, patients with septic shock were in hypocoagulant state (higher K, lower α and CI values); while those in severe sepsis had procoagulant state (lower K, higher α and CI values). Larger trials are needed to confirm our findings.

Keywords: Sepsis, Hemostasis, Thromboelastography
AMOUNT OF VISCERAL ADIPOSE TISSUE IN COMPUTED TOMOGRAPHY IS DOSE-DEPENDENTLY ASSOCIATED WITH MORTALITY IN SEPSIS

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Background/Purpose: Adipose tissue is recognized as an endocrine organ producing proinflammatory cytokines. An impact of visceral adipose tissue in critical illnesses has been proposed. However, research regarding the association between quantitatively measured visceral adipose tissue and sepsis is scant. We conducted this study to determine whether visceral adipose tissue measured quantitatively by abdominal computed tomography may predict sepsis outcomes.

Methods: A retrospective cohort study of 178 patients admitted to our intensive care unit with sepsis, who had abdominal computed tomography within 1 month of occurrence of sepsis. The areas of visceral adipose tissue were measured by calculating pixels presenting fat density.

Results: Median age was 65 years and 59.0% were men. The amount of visceral adipose tissue and the visceral/total adipose tissue ratio were higher in the in-hospital mortality group than in the group of survivors (92.00 cm² vs. 60.82 cm² and 45.88% vs. 32.79%, P < 0.001 and < 0.001, respectively). A multiple logistic regression analysis revealed that the amount of visceral adipose tissue and visceral/total adipose tissue ratio were independent prognostic factors of sepsis with an obvious dose-dependent relationship (visceral adipose tissue/total adipose tissue ratio quartile 3: odds ratio 8.529, P < 0.001 and quartile 4: odds ratio 35.772, P < 0.001, compared with quartile 1, respectively).

Conclusions: The amount of visceral adipose tissue and visceral adipose tissue/total adipose tissue ratio quantitatively measured by computed tomography were positively correlated with mortality in sepsis dose-dependently. Visceral obesity should be considered as the poor prognostic factor of sepsis.

Keywords: Visceral adipose tissue, Sepsis, Abdominal computed tomography, Biomarker, Prognosis

Figure 1. Increased sepsis mortality according to elevated quartile of VAT and VAT/TAT.

Figure 2. Impact of high VAT/TAT on mortality in sepsis.
A HIGH MEAN ARTERIAL PRESSURE TARGET IS ASSOCIATED WITH IMPROVED MICROCIRCULATION IN SEPTIC SHOCK PATIENTS WITH PREVIOUS HYPERTENSION: A PROSPECTIVE OPEN LABEL STUDY

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Background/Purpose: Introduction: The effect of mean arterial pressure (MAP) titration to a higher level on microcirculation in septic shock patients with previous hypertension remains unknown. Our goal is to assess the effect of MAP titration to a higher level on microcirculation in hypertensive septic shock patients.

Methods: This is a single-center open label study. Hypertensive patients with septic shock for less than 24 hours after adequate fluid resuscitation and requiring norepinephrine to maintain a MAP of 65 mm Hg were enrolled. Then MAP was titrated by norepinephrine from 65 mm Hg to patient’s usual level. In addition to hemodynamic variables, sublingual microcirculation was evaluated by sidestream dark field imaging.

Results: Nineteen patients were enrolled in the study. Increasing MAP from 65 mm Hg to patients usual level was associated with increased central venous pressure (from 11±4 to 13±4 mm Hg, p = 0.002), cardiac output (from 5.4±1.4 to 6.4±2.1 L/min, p = 0.001), central venous oxygen saturation (from 81±7 to 83±7 %, p = 0.001). There were significant increases of small perfused vessel density (from 10.96±2.98 to 11.99±2.55 vessels/mm², p = 0.009), proportion of small perfused vessel (from 85±18 to 92±14 %, p = 0.002), and small microvascular flow index (from 2.45±0.61 to 2.80±0.68, p = 0.009) when compared with a MAP of 65 mm Hg.

Conclusions: Increasing MAP from 65 mm Hg to patient’s usual level is associated with improved microcirculation in hypertensive septic shock patients.

Keywords: Sepsis, Septic shock, Microcirculation
EFFECTS OF VITAMIN D DEFICIENCY AND MORTALITY IN SEPTIC PATIENTS IN MEDICAL UNIT OF FACULTY OF MEDICINE VAJIRA HOSPITAL, NAVAMINDRADHIRAJ UNIVERSITY

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Background/Purpose: Vitamin D is a fat-soluble vitamin that maintains body calcium and phosphate metabolism and recent evidence demonstrates low level of vitamin D is found frequently in intensive care patients and associates with an increase in mortality. However, this data is limited in septic patients in medical unit.

Methods: A prospective cohort study was conducted to measure 25-hydroxyvitamin D (25(OH)D) level among patients who were diagnosed with sepsis in medical unit of Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand between November 2014 and March 2015, and analyzed how vitamin D deficiency contributed to 30-day mortality.

Results: Ninety six patients were enrolled, among of them had vitamin D deficiency (25(OH)D level< 20 ng/dL) in 72 (75%), insufficiency (25(OH)D = 20.00-29.99 ng/dL) in 15 (15.6%) and normal level in 9 (9.4%) patients. There was no statistical significance in 30-day mortality between vitamin D deficiency 14/72 (19.44%) and non-vitamin D deficiency 1/24 (0.04%), p = 0.105. However, there was a protective effect of vitamin D level and 30-day mortality OR = 0.83; 95%CI, 0.74-0.94 and OR = 0.81; 95%CI 0.74-0.97 when adjusted for age and APACHE-II. Furthermore, the cut-off vitamin D value at 10 ng/dL potentiated detection in mortality by sensitivity at 73%(95%CI, 45%-100%), specificity at 69%(95%CI, 56%-82%), PPV at 30%(95%CI, 11%-50%), and NPV at 93%(95%CI, 85%-100%) with area under the curve (AUC) was 0.80, p<0.001.

Conclusions: The study demonstrated an association between 25(OH) D deficiency and 30-day mortality and cut-off vitamin D level at 10 ng/dL can predict mortality in septic patients in medical unit.

Keywords: Sepsis, Vitamin D, Vitamin D deficiency, 30-days mortality, ICU
CYTOCHROME C LEVELS IN SEVERE SEPSIS AND SEPTIC SHOCK

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Background/Purpose: Cytochrome C is an essential component of the electron transport chain loosely bound to the inner mitochondrial membrane. Plasma Cytochrome C may be a marker of mitochondrial injury.

Methods: We included patients as part of a randomized, trial of Ubiquinol (reduced form of Coenzyme Q10) in patients with severe sepsis or septic shock (NCT01948063). The results of the trial have been reported elsewhere and no difference was found in Cytochrome C levels or other outcomes between the groups. Blood was drawn at enrollment and 12 and 24 hours later. We used repeated measures analysis to compare cytochrome C levels between survivors and non-survivors. Cytochrome C levels were log-transformed before analysis and a level of 4 ng/mL was imputed for those with undetectable levels.

Results: Thirty-eight patients were enrolled. The median age was 65 years (quartiles: 52, 73) and 18 (47%) were female. Eighteen (47%) received mechanical ventilation at time of enrollment, 24 (63%) received vasoressor support, and 6 (16%) died before hospital discharge. Plasma Cytochrome C levels were detectable in 25 (66%) of the patients at time of enrollment. Cytochrome C levels were higher in patients who died before hospital discharge as compared to survivors (p = 0.02, Figure 1).

Conclusions: Plasma Cytochrome C levels are detectable in approximately 2/3 of severely septic patients. In this preliminary study we found that patients who died had higher Cytochrome C levels as compared to survivors. Cytochrome C might hold promise as a marker of mitochondrial injury or as a prognostic marker in septic patients.

Keywords: Sepsis, Mitochondria, Cytochrome C, Outcomes
FIBROBLAST GROWTH FACTOR 23, A NOVEL BIOMARKER TO DETECT SEVERE SEPSIS

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Background/Purpose: Community acquired pneumonia (CAP) results in severe sepsis in approximately one third of hospitalized patients, and a quarter of these dying before discharge. Clinical risk prediction scores for CAP such as pneumonia severity index (PSI) and CURB65 are not specific for severe sepsis. Novel biomarkers of underlying immune response or physiology could enhance detection of severe sepsis.

Methods: We analyzed 366 patients hospitalized with CAP from a multicenter observational cohort. 80 plasma biomarkers were obtained at presentation in the emergency department based on the literature including procalcitonin (PCT) and compared each alone or in combination using the area under the receiver operating characteristic curve (AUC) to identify severe sepsis. We also evaluated PSI and CURB65 alone and together with biomarkers.

Results: PSI and CURB65 did not perform well for detecting severe sepsis, AUCs 0.68 and 0.63 and did not improve when used in combination. Similarly PCT was not predictive (AUC 0.68). By contrast, fibroblast growth factor 23 (FGF23) exhibited an AUC of 0.74 alone and 0.77 in combination with either PSI or CURB65 ($p<0.05$). No other biomarker combinations were significant when added to FGF23. A cutoff value of 0.0082 ng/mL provided high sensitivity (85%) while still maintaining reasonable specificity (47%).

Conclusions: Neither existing risk prediction scores nor any of 80 plasma biomarkers, including PCT, performed well for detection of severe sepsis by the end of hospital day-1 in patients admitted with CAP. FGF23 performed best of all biomarkers and when combined with PSI or CURB65 provided the best accuracy.

Keywords: FGF 23, Severe sepsis, Novel biomarker
**DIAGNOSIS OF INFECTION UTILIZING ACCELLIX CD64**

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**Background/Purpose:** Differentiating patients who are infected or not in the intensive care unit (ICU) can be very difficult. Present diagnostic tests remain inadequate. CD64 has been found to be a potentially useful marker to identify infected patients. Unfortunately, CD64 measured by standard flow cytometers in a laboratory takes hours to perform. The purpose of this study was to evaluate the Accellix CD64 instrument which provides results in 20 minutes in ICU patients with and without infections.

**Methods:** Infected (ICUi) and non-infected ICU patients (ICU Control-ICUc) and normal volunteers (C) had CD64 levels measured by the Accellix CD64 instrument. Measurements were calculated as CD64 index, i.e. the ratio between the fluorescence of the PMN population and the fluorescence of control beads. ICU infection, ICU control and normal control patients results can be seen in Figure 1.

**Results:** Sixty patients were studied (ICUi- 17, ICUc-13 and C-30). CD64 Index levels were higher (mean ± SEM) in ICU infection patients than ICU control and normal control patients (2.49 ± 0.42 vs. 1.28 ± 0.3 vs. 0.56 ± 0.02. p = 0.03 for ICUi vs. ICUc, p<0.001 for ICUi vs. C).

**Conclusions:** CD64 Index levels are higher in infected than non-infected ICU patients. Accellix CD64 is a promising instrument to differentiate infected from non-infected ICU patients in a timely manner.

Keywords: Infection, ICU, Accellix, CD64
IMPACT OF RENAL DYSFUNCTION ON PHARMACOKINETICS OF RECOMBINANT HUMAN THROMBOMODULIN

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Background/Purpose: Thrombomodulin alfa (TMα) is a soluble recombinant human thrombomodulin that has been shown to enhance the reversal of disseminated intravascular coagulation (DIC) and may reduce mortality in subjects with sepsis and DIC. Many sepsis patients have renal impairment, and since TMα is renally cleared, therefore understanding the effects of renal impairment on pharmacokinetics is essential to patient safety. The purpose of this study is to clarify the impact of renal dysfunction on TMα pharmacokinetics (PK).

Methods: Population pharmacokinetic (PPK) analysis of TMα was performed using rich samples collected in 24 healthy subjects and sparse samples collected in 368 subjects with sepsis and DIC. In addition, a PK study was conducted in 5 groups of 8 subjects each with different degrees of kidney injury including end stage renal disease (ESRD) undergoing hemodialysis.

Results: PPK analysis indicated that renal function affected the clearance of TMα but the simulated plasma concentration did not reach the level that is known to increase the bleeding risk (>13,000 ng/mL) even in the severe renal impairment group (15<Ccr≤30 mL/min). Sub-analysis by population with severe renal impairment in the global Ph2b study suggested that there were no differences in bleeding events between TMα and Placebo (Standard of Care).

Conclusions: The results of the renal PK study indicated there are no differences in PK between severe impairment and ESRD. Based on the above results, no dose adjustment would be needed for renal impairment including ESRD regardless of their status on hemodialysis.

Keywords: Thrombomodulin alfa, End stage renal disease, Pharmacokinetics
THE ROLES OF THE ACE INHIBITOR CAPTOPRIL ON INFLAMMATORY RESPONSE IN SEPTIC HUMAN NEUTROPHIL AND MORTALITY IN ENDOTOXEMIC MICE

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Background/Purpose: Angiotensin - converting enzyme (ACE) mediates inflammatory response in healthy lungs via angiotensin II and plasminogen activator inhibitor -1. Neutrophils play an important role in the development of acute lung injury associated with severe sepsis. However, the ability of ACE directly participating in LPS-induced neutrophil activation has not been fully examined. This study was performed to evaluate the effects of the ACE inhibitor captopril on lipopolysaccharide (LPS) - induced neutrophil activation and mortality in LPS - induced endotoxemic mice.

Methods: To assess possible interactions between captopril and LPS on neutrophil activation, neutrophils from human blood were incubated with various concentrations of captopril (0, 1, 10, 50 and 100 nM) and LPS (100 ng/ml). The protein levels for interleukin (IL)-6, 8 and tumor necrosis factor (TNF)-α were measured using ELISA 4 hr after incubation period. To elucidate the intracellular signaling pathway, We measured the levels of phosphorylation of p38 mitogen activated protein kinases (p38), extracellular signal-regulated kinase (ERK)1/2 and c-Jun amino-terminal kinases (JNK) with western blot analysis and nuclear levels of nuclear factor (NF)-κB with electrophoretic mobility shift assays 0.5 hr after incubation period. We also examined the effect of captopril (30mg/kg, IP) on mortality of mice treated with LPS (20 mg/kg, IP) to determine whether these effects of captopril also have in vivo significance.

Results: Captopril attenuated LPS - induced neutrophils activation including expression of p38, JNK, NF-κB, IL-6, 8 and TNF-α. Captopril also attenuated mortality in LPS - induced endotoxemic mice.

Conclusions: Captopril can attenuate mortality in LPS - induced endotoxemic mice via the attenuation of neutrophil activation caused by LPS.

Keywords: Acute lung injury, Cytokine, LPS, Captopril, ACE inhibitor
THE PROTECTIVE EFFECT OF REMOTE ISCHEMIC CONDITIONING IN A SEPTIC MICE MODEL

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Background/Purpose: Sepsis remains the leading cause of death in surgical intensive care unit. Prior studies have demonstrated a survival benefit of remote ischemic conditioning (RIC) in many diseases. The aim of the study was to determine the effects of RIC on survival in sepsis.

Methods: 8-12 week mice received intra-peritoneal injection of lipopolysaccharide (LPS). Septic animals in experimental group underwent RIC at two hours after LPS. The femoral artery was dissected and six 4 minute-cycles of ischemia-reperfusion were performed. Primary outcome was survival at 5 days post-LPS injection. Secondary outcome was serum levels for interferon-γ (IFN-γ), interleukin (IL)-10, IL-1β, and tumor necrosis factor-alpha (TNF-α) before LPS injection and at 0, 2, 4 and 24 hours post RIC. Kaplan-Meier survival analysis was performed.

Results: We performed experiments on 24 mice: 14 controls and 10 RIC mice. 70% (7/10) of mice in the RIC group survived 5 days compared to only 21% (3/14) of mice in the control group. RIC group had increased survival at 5 days post-LPS (p=0.0453) with hazard ratio of 0.296 (95% CI 0.09, 0.98). In the RIC group, levels of IFN-γ, IL-10, IL1β, and TNFα peaked at 2 hours post-RIC and then decreased significantly over 24 hours (p<0.0001) compared to the control group. There was a 0.7, 1.9, and 0.5 fold decrease in the IL-10, IL1β, and TNFα in the RIC group at 24 hours, respectively, compared to the pre-treatment (0hr) level (p<0.0001).

Conclusions: RIC improves survival in sepsis and has potential for implementation in the clinical practice.

Keywords: Sepsis, Remote ischemic conditioning, Inflammatory profile


**AMOUNT OF CONDENSATION IN THE LIMB OF HIGH-FLOW NASAL CANNULA THERAPY: A BENCH STUDY**

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**Background/Purpose:** High-flow nasal cannula (HFNC) is popular for patients with acute respiratory faire. HFNC is considered to supply adequate humidification compared to conventional oxygen devices. To maintain adequate humidification, it is important to avoid occurrence of dew condensation in the limb. We investigated if brand of limb, HFNC flow and environmental temperature influenced on occurrence of dew condensation in the limb.

**Methods:** We evaluated two brands of HFNC limb, Flex 22mm single limb heating; SLH (Intersurgical), and RT202 (Fisher & Paykel). For both limbs, water-chamber (MR290, Fisher & Paykel) with heated humidifier (MR850, Fisher & Paykel) was connected. HFNC flow was set at 20, 40 and 60 L/min, FiO₂ at 0.21. Environmental temperature was controlled at 20 and 25 degrees Celsius by air conditioner. We measured weight of the limb by digital weight scale (NVT1601JP/2, OHAUS) at 0, 3, 6 and 24 h after start of the experiment, and calculated amount of dew condensation.

**Results:** Under environmental temperature of 25 degrees Celsius, the amount of dew condensation was small. Under environmental temperature of 20 degrees Celsius, at HFNC flow of 20 L/min, the amount of dew condensation was 50.2±10.7 mg with SLH, and 96.0±35.1 mg with RT202 for 24 h, respectively. At 40 L/min, it was 44.3±17.7 mg with SLH and 72.8±8.2 mg with RT202, and at 60 L/min, 56.6±13.9 mg with SLH and 64.9±0.8 mg with RT202, respectively.

**Conclusions:** We investigated amount of dew condensation in the limb of HFNC. Low environmental temperature influenced occurrence of dew condensation in the limb significantly.

**Keywords:** Temperature, Medical gas, Active humidifier
NASAL HIGH FLOW THERAPY AND DISPERSION OF NASAL AEROSOLS IN AN EXPERIMENTAL SETTING

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Background/Purpose: Nasal High Flow (NHF) therapy delivers flows of heated and humidified gases up to 60L/min via a nasal cannula. NHF is widely used to support patients, including those that may be infectious. It is thought that NHF gas flow velocities may increase cross-infection risk.

Methods: Aerosols within the exhaled breath of healthy volunteers were imaged. Experimental breathing conditions deemed as typical patient breathing conditions were tested: at rest, with a violent exhalation (snorting), both with and without NHF, at flows of 30 and 60L/min, and for both separate nostrils. The number, diameter, evaporation rates, and velocity of exhaled aerosols were collected.

Results: Numbers of aerosols measured were greatest during a violent exhalation without NHF and reduced with NHF. Numbers of aerosols were higher at 60 than 30L/min, suggesting higher gas flow rates may be associated with increased aerosol production; however, the numbers were on average 43% and 56% less than without NHF, respectively. During breathing at rest, no differences were imaged between with and without NHF, except at 60L/min where numbers of aerosols produced were equivalent to 10% of a violent exhalation. Aerosol trajectory and evaporation rates observed both with and without NHF predicted that aerosols between 25 to 250μm may travel up to 4.4m and remain airborne for 43 seconds.

Conclusions: NHF use does not increase the risk of dispersing infectious aerosols above the risk of typical patient breathing with violent exhalation which is the worst case clinical scenario; therefore standard risk control measures should apply.

Keywords: Nasal high flow, Infection control
RAISING THE STANDARD OF CARE FOR OXYGEN DELIVERY WITH NASAL HIGH FLOW IN HIGH ACUITY AREAS - A CONTROLLED STUDY

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Background/Purpose: Efficacy of High Flow Nasal Cannula (HFNC) as a form of respiratory therapy is established. Introducing HFNC for all oxygen delivery, patient outcomes in a combined Intensive, High and Coronary Care Unit could be improved.

Methods: Observational historic controlled two-phase study involving (N=864) high acuity patients with a requirement for O2. During retrospective phase I (N=450), the most common diagnostic categories and practice for O2 delivery were established. During prospective phase II (N=414), conventional O2 delivery devices were replaced with HFNC (OptiflowTM using AirvoTM flow source Fisher and Paykel Healthcare Ltd). Recruitment matched retrospective phase numbers. For both phases 40 hours post admission data were extracted: level of respiratory support required, HFNC usage, length of stay, vital status and destination at discharge, and rate of therapy failure requiring escalation.

Results: The benefit ratio between the phases was equivalent at baseline. The level of respiratory support required for HDU and CCU patients was significantly changed between two cohorts (Fishers Exact Test, p-values <.0001). No significant differences for: level of respiratory support for ICU patients (Fishers Exact Test, p-values >0.05), and length of stay or mortality for all (non-parametric Wilcoxon two-sample test, p-values >0.05). Mean (+/- standard deviation) for HFNC therapy: maximum duration 7 hours (10.16), average FIO₂ 30.4% (9.58), flow L/min 31.5 (6.66), SpO₂ 95.8 (4.99). Therapy failure rates requiring support escalation were equivalent (p-value=0.37).

Conclusions: For the majority, HFNC use was associated with reduction in required level of respiratory support, the requirement for escalation of support remaining unchanged.

Keywords: Nasal high flow, Escalation
THE PROGNOSIS OF THE PATIENTS WHO TREATED WITH HIGH FLOW NASAL CANNULAE COMPARED TO CONTINUOUS POSITIVE AIRWAY PRESSURE THERAPY IN SEVERE ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Background/Purpose: Although high flow nasal cannula (HFNC) oxygen therapy has been used gradually as a method of respiratory support, its evidence is still lacking. Non-invasive positive pressure ventilation (NIPPV) has been used in chronic obstructive pulmonary disease (COPD) patients, especially with severe acute exacerbation of COPD (AECOPD). The purpose of this study is to investigate and compare the prognosis of severe AECOPD patients who were treated with HFNC therapy and NIPPV.

Methods: We conducted a prospective randomized controlled trial to compare HFNC therapy with NIPPV for patients (≥ 40 year-old) with severe AECOPD in a tertiary referral hospital. 72 patients with severe AECOPD having mild to moderate respiratory failure were enrolled in this prospective study. We evaluated 30-day mortality and the duration switching from two devices to conventional oxygen therapy.

Results: The mean age was 72.2 ± 9.4 years (76.4% of male) and mortality rate was 16.6%. Forty-two patients (72.0 ± 9.1) were managed with HFNC oxygen therapy, and 30 patients (73.1 ± 10.4) with NIPPV. 30-day mortality was 14.0% and 19.0% (P=0.313) in each treatment group and the duration switching from two devices to conventional oxygen therapy was 7.1 ± 6.6 and 6.4 ± 7.8 days (P=0.105), respectively.

Conclusions: In severe AECOPD patients with mild to moderate respiratory failure, HFNC oxygen therapy compared to NIPPV did not show a statistical difference in 30-day mortality and the duration until the AECOPD gets improved. We expect that HFNC can be used substitutingly in severe AECOPD patient requiring NIPPV, however, more prospective and multi-center studies should be required.

Keywords: Acute exacerbation; Chronic obstructive pulmonary disease; high flow nasal cannula, Non invasive ven
PULMONARY ARTERY TO AORTA RATIO IS CORRELATED WITH PULMONARY ARTERY PRESSURE, BUT NOT WITH MORTALITY IN CRITICALLY ILL COPD PATIENTS

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Hacettepe University Faculty of Medicine Medical Intensive Care Unit, Turkey

Background/Purpose: Identification of COPD patients at high risk for complications and mortality is important. Computed tomography (CT) can be used to measure the ratio of the diameter of the pulmonary artery (PA) to the diameter of the aorta (A). We hypothesized that pulmonary artery enlargement, as shown by a PA/A ratio >1 could be associated with a higher risk of mortality in COPD patients admitted to the intensive care unit (ICU).

Methods: Data of patients admitted to the ICU were retrospectively reviewed. Patients who were identified to have a diagnosis of acute exacerbation of COPD and who had an echocardiogram and a CT scan were included. PA/A ratio was calculated and patients were grouped as PA/A ≤1 and PA/A >1. Analyses were done to demonstrate the correlation between ICU mortality and PA/A.

Results: One hundred and six COPD patients were enrolled. There were 40 (37.4%) patients who had PA/A >1. Pulmonary arterial pressure (PAP) was higher in the group with PA/A >1 than in those with PA/A ≤1 (62.1±23.2 mm Hg vs 45.3±17.9 mm Hg, p=0.002). Mortality rate of patients with a PA/A >1 was higher (50%) than of those patients with a PA/A ≤1 (36.4%) (p= 0.17). Correlation was found between CT scan-measured PA diameter and PAP (r=0.51, p=0.001) as well as between the APACHE II values and PAP (r=0.25, p=0.025).

Conclusions: The PA/A ratio is an easily measured method that can be performed on thorax CT scans. PA/A can be used as a surrogate marker to predict the pulmonary hypertension and ICU prognosis.

Keywords: Pulmonary artery pressure, COPD, ICU, Computed tomography
TREATMENT WITH EXTRACORPOREAL MEMBRANE OXYGENATION AT TOKUSHIMA UNIVERSITY HOSPITAL

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Background/Purpose: Extracorporeal membrane oxygenation (ECMO) is a prolonged cardiopulmonary support, and the impact of ECMO on clinical outcome is incredible. We started training physicians and medical engineers for ECMO several years ago, and started ECMO treatment. In the present study, we retrospectively reviewed medical records of patients treated with ECMO at our intensive care unit (ICU).

Methods: We retrospectively reviewed medical records of patients treated with ECMO between January 2013 and February 2015. Baseline profiles, underlying diseases, type of ECMO (venoarterial or venovenous), complications, length of ECMO, and outcome were collected.

Results: Sixteen patients were treated with ECMO. Age was ranged from 0-75 (neonates; 5, pediatrics; 3, and adults; 8). Underlying diseases were post-cardiac surgery; 8, acute respiratory distress syndrome (ARDS); 2, acute pulmonary thromboembolism; 2, refractory arrhythmia; 1, myocarditis; 1, postpartum hemorrhage; 2. All but one patient were treated with venoarterial ECMO. Venovenous ECMO was introduced to a child of hematological malignancy developing severe ARDS. Length of ECMO ranged 1-36 days. Ten patients were discharged from ICU alive. Causes of death were intracranial hemorrhage; 2, respiratory failure; 2, and multi-organ failure; 2. No major complications related to ECMO.

Conclusions: Fifteen out of 16 patients were treated with venovenous ECMO. Only one patient was treated with venoarterial ECMO, because many of our patients were suffered from cardiovascular instability. We retrospectively reviewed patients treated with ECMO. In the entire age group ECMO was introduced for a variety of underlying diseases.

Keywords: Survival, Venovenous ECMO, Venoarterial ECMO
THE GUIDELINE TRANSPLANTATION FROM A COUNTRY TO ANOTHER COUNTRY - THOROUGH EDITING THE JAPANESE PAD (PAIN, AGITATION AND DELIRIUM) GUIDELINE -

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Background/Purpose: The SCCM of US presented the two guidelines for the sedation in early 2013. The JSICM projected to promote the guidelines like this and it for the sepsis had been already published. We got the chance to edit the guideline about the agitation and delirium (PAD) from the JSICM. The original evaluation for the evidences by SCCM had to be respected, because many important evidences were already discussed during editing course.

Methods: The problems to transplant the guideline to another country were discussed through this chance.

Results: 1). The English word, "pain", will include the more meanings than the Japanese word, "Itami". 2) Some drugs, e.g. hydromorphone etc., recommended in the SCCM guideline could not be available in Japan. 3) The GRADE evaluation had to be changed by the difference of above situation. 4) There were some differences of the expression in various feelings. 5) There were some differences in the system of ICU, which contained the relationship with the co-medical staffs or the arrangement of nurses. 6) There were the difficulties of evaluation for the evidences in some procedures.

Conclusions: The field of the management in pain, agitation and other fields, e.g. the respiration, circulation and more. The evidences may be evaluated again when each guideline in own country will be established.

Keywords: Guideline, Foreign Country, Pain, Agitation, Delirium
FLUORIDE LEVELS WITH LONG-TERM VOLATILE SEDATION WITHIN THE INTENSIVE CARE UNIT

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Background/Purpose: The use of volatile-based sedation is gaining popularity in many ICUs. However, there is limited safety data assessing serum fluoride (SF) levels and nephrotoxicity during prolonged use of these agents. Safe levels for modern less soluble volatile agents are unknown. This report documents fluoride levels and renal function measured in patients recruited to the Use of Volatile Anesthetic Agents of Long-Term critical Care Sedation (VALTS) trial.

Methods: VALTS is a prospective 2-arm RCT recruiting patients who require mechanical ventilation for > 48h. With REB approval, patients are randomized to receive inhaled isoflurane or intravenous propofol/midazolam sedation using an explicit bedside sedation/analgesia protocol until extubation or tracheostomy. Isoflurane is administered using the Anesthetic Conserving Device. SF levels are measured every 48h for up to 4 measurements during sedation. Patient renal function is reported as the glomerular filtration ratio (GFR).

Results: 14 patients received isoflurane sedation for mean (SD) 118 ± 71 hours with daily infusion volumes of 38.5 ± 21.5 ml/h. The mean daily end-tidal isoflurane concentration was 0.33 ± 0.18. 4 patients had a history of chronic renal failure. SF levels rose with duration of sedation with 1 non-dialysis patient achieving a fluoride level of 56 umol/l at day 7, table 1. There was no significant correlation between serum fluoride levels and GFR (R 0.14, p 0.14) or daily isoflurane infusion volume (R 0.05, p 0.76).

Conclusions: SF levels rise with the duration of volatile sedation. However levels appear not to be correlated with renal function.

Keywords: Volatile-based sedation, ICU, Fluoride

Table 1. Serum fluoride levels

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SEDATIVE USE AND DELIRIUM DURING NONINVASIVE
POSITIVE PRESSURE VENTILATION: A PROSPECTIVE
OBSERVATIONAL STUDY

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Background/Purpose: Noninvasive positive pressure ventilation (NPPV) has been used to treat acute respiratory failure in intensive care units (ICU), while some patients need tracheal intubation because of not only underlying diseases but also other conditions, including delirium. Delirium in patients receiving NPPV has been little studied. The aim of the study was to discover the incidence of delirium in our NPPV patients.

Methods: Adult patients who received NPPV were enrolled. Basic profiles of patients, underlying diseases, indication of NPPV, duration of NPPV, length of stay in ICU, NPPV settings, and outcome were collected. Delirium was diagnosed with the Confusion Assessment Method for the ICU (CAM-ICU) by attending nurses.

Results: Forty-three adult patients who received NPPV were enrolled. For all patients, NPPV was applied via full face mask. The diagnosis of 30 patients (69%) was cardiogenic pulmonary edema. Delirium was observed in 16 patients (37%). Patients with delirium were older than those without (78.4 vs. 69.5 years old, p = 0.031). Thirty-one patients (72%) were successfully weaned from NPPV. NPPV failure rate was 38% for patients with delirium and 22% for patients without (p = 0.313).

Conclusions: Thirty-nine percent of our normocapnic patients developed delirium during NPPV, and the incidence was as high as in hypercapnic patients.

Keywords: CAM-ICU, Dexmedetomidine, Cardiogenic pulmonary edema
THE EFFECT OF A PHARMACISTS INTERVENTION TO PROMOTE COMPLIANCE OF A SEDATION PROTOCOL IN A MEDICAL ICU

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Background/Purpose: To promote adherence to protocolized analgo-sedation strategy, a ICU pharmacist has a pivotal role. The purpose of this study was to validate the impact of a pharmacists intervention on clinical outcomes in a medical ICU.

Methods: The pharmacist reinformed the physicians and nurses in the use of the protocol, emphasizing intermittent analgesic dosing prior to starting continuous infusions and daily sedation interruption. Additionally, formal audit and feedback were conducted regularly. In the control group, 144 admissions were collected retrospectively over a 3-month period from February to April 2014. In the intervention group, 155 admissions were reviewed prospectively over a 3-month period from June to August 2014.

Results: After intervention, the duration of ICU stay and mechanical ventilation were not changed (median: 4 days vs. 4 days; 3 days vs. 4 days, respectively). Although there was a trend toward increased continuous opioid use (median total dose per patients: 9310.4 mcg vs. 11584.0 mcg) and decreased benzodiazepine, propofol use (median total dose per patients: 329.7 mg vs. 63.3 mg; 4441.7 mg vs. 1386.7 mg, respectively), significant differences were not found. However, wakefulness increased (mean Richmond Agitation Sedation Scale: -0.62 vs. -0.44, p <0.001), and the proportion of the days awake and not delirious increased (negative Confusion Assessment Method for the ICU: 35.9% vs. 40.8%, p<0.001).

Conclusions: A pharmacist’s intervention on implementing the sedation protocol did not demonstrate any reduced duration of stay in the ICU or mechanical ventilation, but may be helpful to minimize deep sedation and delirium.

Keywords: ICU, Pharmacist, Intervention, Analgo-sedation, Sedation protocol
OUTCOME OF DELIRIUM DURING INTENSIVE CARE UNIT STAY IN JAPAN

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Background/Purpose: Delirium has been recognized that associated with impaired outcome, but in Japan, still underdiagnosed form of acute brain dysfunction. The aim of this study was to investigate the association between delirium in the intensive care unit (ICU), outcome and other factors.

Methods: A prospective cohort study was conducted on ICU patients for 6 months at a general hospital in Tokyo, Japan. We included patients who assessed by nursing staff twice daily with the Confusion Assessment Method for the ICU (CAM-ICU) and the Richmond Agitation-Sedation Scale. Cox regression with time-varying covariates was used to determine the independent relationship between delirium and clinical outcomes.

Results: Of 251 patients, 138 (55%) were male, mean age was 65.3± 18.0 years old, length of ICU stay was 3.3±3.7, length of hospital stay was 28.6± 39.0. Among the patients, 46 (18%) developed delirium at some point during the ICU stay. Judging from DSM-IV, 39(16%) were diagnosed by psychotherapic physician. A bi-variate analysis showed several different factors (dementia, infection, postoperative, respiratory failure, cardiac decompensation, benzodiazepine, steroid) were the associate with delirium. Patients who developed delirium had higher 6-month mortality rates (39% vs 9%), and length of ICU and hospital stay (6.0day vs 2.7day, 49.8day vs 24.7day).

Conclusions: Delirium occurred 18% in this cohort. Delirium was an independent predictor of higher 6-month mortality and longer hospital stay.

Keywords: Delirium, CAM-ICU
CEREBRAL PERFUSION PRESSURE MANAGEMENT IN DECOMPRESSIVE CRANIECTOMY PATIENTS

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Background/Purpose: In patients with increased intracranial pressure, cerebral perfusion pressure more than 70 mmHg is critical for the survival of the victims. An alternative therapeutic strategy is decompressive craniectomy that will decrease the ICP and improve the CPP. Authors tried weather the CPP value could be decreased for the patients with decompressive craniectomy.

Methods: 133 patients who had undertaken decompressive craniectomy and monitored ICP after the surgery were included in this retrospective analysis. The mean age was 48.1 years (ranged 1 to 82 years, M:F=90:43). 48 patients were traumatic brain injury, 62 patients were cerebral stroke, 23 patients were cerebral aneurysm and 2 patients were other causes. CPP was calculated from the mean arterial pressure minus ICP in every two hours after the surgery. The patients, neurologic outcome evaluated at 3 months after the surgery.

Results: Cerebral perfusion pressure and mean arterial pressure shows positive correlation with the clinical outcome. Initial intracranial pressure and ICP after the surgery shows reverse correlation with the clinical outcome. In Chi-square analysis of the CPP value over 70 mmHg during the postoperative period shows statistically good results (p<0.05).

Conclusions: From this study, decompression surgery is benefit to decrease the intracranial pressure and convenience for the cerebral perfusion pressure management. Cerebral perfusion pressure should be maintained more than 70 mmHg even in the patients who underwent craniectomy.

Keywords: Cerebral perfusion pressure, Decompressive craniectomy
CORRELATIONS BETWEEN THE ICP AND MIDLINE SHIFT IN ACUTE IICP PATIENTS

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Background/Purpose: Midline shift on brain CT is a remarkable finding of the acute increased intracranial pressure (ICP) patients. There are many reports concerned about the correlations between the ICP and midline shift on brain CT, but the statistical correlations are inconclusive. Authors measured the initial ventricular ICP and the amount of midline shift, and found a significant correlation between these two factors.

Methods: 86 patients who had undertaken decompressive craniectomy were included in this study. The mean age was 50.5 years (ranged: 22-78). All patients performed brain CT within 3 hours before the surgery. And the initial ventricular pressures were measured through the catheter before the decompression surgery.

Results: The amount of midline shift was correlated with the initial ventricular ICP. Regression analysis showed “midline shift = 0.073 x Initial ICP + 8.91” (P<0.05). But the clinical results of the patients were not correlated with the amount of midline shift.

Conclusions: From this study, authors found the correlations between the midline shift and ventricular pressure. But the statistical residues in each patient were quite large, and the clinical outcomes were not correlated with the midline shift. Authors thought that brain compliance as well as ICP should be considered to explain the midline shift.

Keywords: Midline shift, Increased intracranial pressure
THE THRESHOLD OF OPTIC NERVE SHEATH DIAMETER BY OCULAR ULTRASONOGRAPHY FOR THE DETECTION OF INCREASED INTRACRANIAL PRESSURE IN KOREAN ADULT PATIENTS WITH BRAIN LESIONS

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1Hallym University College of Medicine, Republic of Korea, 2Seoul National University College of Medicine, Republic of Korea

Background/Purpose: Previous studies have shown that optic nerve sheath diameter (ONSD) over 5mm using an ocular ultrasonography (US) is useful for the detection of IICP in a Caucasian population-based cohort. However, cut-off point value which optimally stratifies IICP has not been studied in Korean population. This study was started to identify the cut-off point value of the ONSD for the detection of IICP in adult patients.

Methods: This prospective analysis was done for suspected IICP patients suffering from traumatic brain injury, tumor or hemorrhage in three participating institutions from April, 2013 to April 2015. The measurements of ONSD were done by a qualified neurosurgeon and an anesthesiologist using a 13MHz liner probe. The interpretation of the CT and MRI were done by two neurosurgeons. A receiver operating characteristic curve was constructed to determine the ONSD cut-off point.

Results: A total of 78 patients who suspected IICP were enrolled. Their mean age was 48.2± 13.2 years and female genders were 41 (52.36%). Among them, 56 patients showed IICP according to MRI or CT. The mean ONSD for patients with IICP or without IICP were 5.91±0.31mm and 5.22±0.28mm, respectively. The ONSD cut-off point for identifying IICP was 5.5mm with a sensitivity of 94.34% (95% CI: 84.3-98.8) and a specificity of 86.67% (95% CI: 59.5-98.3).

Conclusions: The cut-off point of ONSD by ocular US in Korea is 5.5mm which is lower than that in a Caucasian population. Accordingly, ethnic difference should be taken into account when using ONSD for the detection of IICP.

Keywords: Optic nerve sheath diameter, Increased intracranial pressure, Ultrasonography
OUTCOMES AFTER SPINAL CORD INJURY IN PATIENTS WITH PREVIOUS ANEMIA: A NATIONWIDE POPULATION-BASED STUDY

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Background/Purpose: Factors associated with complications and mortality after spinal cord injury (SCI) was not completely understood. The purpose of this study is to evaluated post-SCI complications and mortality in patients with and without previous anemia.

Methods: Using Taiwanese National Health Insurance Research Database, a nationwide population-based study was conducted of 9049 patients who suffered from SCI with hospitalization between 2008 and 2012. Outcomes after SCI were compared between people with and without previous anemia within 24-month period before SCI. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of 30-day complications and mortality after SCI associated with previous anemia were calculated in the multivariate logistic regressions.

Results: The incidences of post-SCI acute renal failure for people with (n=399) and without (n=8650) previous anemia were 1.8% and 0.6%, respectively (p=0.0081). Patients with previous anemia had higher post-SCI mortality than those without anemia (2.5% vs. 0.7%, p<0.0001). Among patients with SCI, previous anemia was associated with post-SCI acute renal failure (OR 2.42, 95% CI 1.02-5.73) and mortality (OR 2.82, 95% CI 1.27-6.23) after adjusted for sociodemographics and coexisting medical conditions.

Conclusions: In this nationwide population-based study, we investigated that previous anemia was associated with acute renal failure and 30-day mortality after SCI.

Keywords: Anemia, Spinal cord injury, Complications, Mortality
HEALTHCARE WORKERS OPINION REGARDING OUTCOME FOLLOWING SURGICAL INTERVENTION FOR SEVERE TRAUMATIC BRAIN INJURY

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Background/Purpose: There is currently much interest in the use of decompressive craniectomy in the management of severe traumatic brain injury. The aim of this study was to assess whether objective assessment of the risk of an unfavourable outcome would influence healthcare workers opinion regarding decompressive craniectomy for the patients with severe traumatic brain injury (TBI).

Methods: A two-part structured interview was used to assess the participants’ opinion to perform decompressive craniectomy for three patients who had very severe traumatic brain injury. Their opinion was assessed before and after knowing the predicted risk of an unfavorable neurological outcome and the observed long term outcome in various scenarios.

Results: Five hundred healthcare workers with a wide variety of clinical backgrounds participated. The participants were significantly more likely to recommend decompressive craniectomy for their patients than for themselves (mean difference in VAS 1.5, 95% confidence interval 1.3 to 1.6), especially when the next of kin of the patients requested intervention. The atients’ preferences were more similar to patients who had advance directives. The participants’ preferences to perform the procedure for themselves and their patients both significantly reduced after knowing the predicted risks of unfavourable outcomes, and the changes in attitude were consistent across different specialties, amount of experience in caring for similar patients, religious backgrounds, and positions in the specialty of the participants.

Conclusions: Access to objective information on risks of unfavourable outcomes influenced healthcare workers decision to recommend decompressive craniectomy for patients with very severe TBI.

Keywords: Neurotrauma, Outcome
ISCHEMIC STROKE IN CRITICALLY ILL PATIENTS WITH MALIGNANCY

Jeong-am Ryu, Jeong Hoon Yang, Daesang Lee, Gee Young Suh, Joongbum Cho, Chi Ryang Chung, Chi-min Park, Oh Young Bang, Kyeongman Jeon

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Ischemic stroke (IS) in the critically ill cancer patients is associated with significant morbidity and mortality. We investigated the clinical characteristics and predictors of IS in critically ill cancer patients.

Methods: All consecutive patients were retrospectively evaluated who underwent brain magnetic resonance imaging (B-MRI) for suspicion of IS with acute abnormal neurologic symptoms or signs developed in the oncology medical intensive care unit of Samsung Medical Center from March 2010 to February 2014. A multiple logistic regression analysis was used to identify independent predictors of IS.

Results: Over the study period, a total of 88 cancer patients underwent B-MRI scanning for suspicion of IS, with altered mentality in 55 (63%), hemiparesis in 28 (32%), and seizure in 20 (23%) patients. 43 (49%) patients had a final diagnosis of IS. Multiple territorial lesions were most common stroke-subtype (81%). Only 8 (18%) non-stroke patients had brain metastasis. Most non-stroke patients (29%) had normal B-MRI findings. After adjusting for potential confounding factors, seizure (adjusted OR 0.141; 95% CI, 0.027-0.736) was inversely associated with IS. Neurological sign of hemiparesis (adjusted OR 5.339; 95% CI, 1.521-19.163) was significantly associated with IS in critically ill cancer patients.

Conclusions: Approximately half of critically ill cancer patients diagnosed with IS when underwent B-MRI scanning for suspicion of IS during their ICU stay. However, brain metastasis was relatively rare. Generally, it is difficult to determine stroke by symptom alone, but hemiparesis may be helpful neurological sign to distinguish IS in critically ill cancer patients.

Keywords: Ischemic stroke, Cancer, Brain magnetic resonance
INTENSIVE MEDICAL THERAPY WITH THERAPEUTIC HYPOTHERMIA FOR MALIGNANT MIDDLE CEREBRAL ARTERY INFARCTION

Kyu Sun Lee, Jin Soo Lee, Ji Man Hong
Ajou University Medical Center, Republic of Korea

Background/Purpose: Malignant middle cerebral artery (MCA) infarction is a large hemispheric infarct caused by proximal MCA or internal carotid artery occlusion with deteriorating progress. Decompressive hemicraniectomy has been regarded effective for increased intracranial pressure. However, it might not be available in elderly or medically unstable patients. Therefore, we compared clinical findings and prognosis between intensive medical therapy with hypothermia (best medical therapy group) and decompressive hemicraniectomy (surgery group) for malignant MCA infarction.

Methods: We collected acute MCA infarction patients who underwent brain MRI within 6 hours since onset in a stroke center over 4 years. Malignant MCA infarction was defined as >82 mL on DWI within 6 hours or >145 mL on follow-up DWI or CT.

Results: Among total 46 cases, best medical therapy group were 18 and surgery group were 16. Initial National Institutes of Health Stroke Scale (NIHSS) did not differ between the groups. Initial infarct volume on DWI within 6 hours significantly differ between the groups: mean 254.0±107.0mL in surgery vs 127.2±44.0mL in best medical therapy (p<0.001). NIHSS at discharge, prevalence of good outcome (mRS 0-2) and mortality at 3 months did not differ between the groups. The prevalence of poor outcome (mRS 5-6) at 3 months significantly differ between the groups: 14(87.5%) in surgery and 16(53.3%) in best medical therapy (p=0.020).

Conclusions: This study suggests that intensive medical therapy with hypothermia has lower prevalence of poor outcome than decompressive hemicraniectomy despite relatively similar clinical severity on baseline. Therefore, systematized medical therapy with therapeutic hypothermia might be a feasible strategy to avoid invasive hemicraniectomy in malignant MCA infarction.

Keywords: Malignant middle cerebral artery infarction, Decompressive hemicraniectomy, Therapeutic hypothermia
HIGH POSITIVE FLUID BALANCE COULD BE HARMFUL FOR THE BRAIN IN SHOCK PATIENTS

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Background/Purpose: High positive fluid balance aggravates kidney and lung injury in critically ill patients but it is not known if this could be harmful for the brain. We investigated whether high positive fluid balance was associated with brain dysfunction and delirium in shock patients including septic and cardiogenic shock.

Methods: Cumulative fluid balance during the first five days after ICU admission was evaluated in 100 shock patients. Delirium and coma were assessed using the Richmond Agitation Sedation Scale (RASS) and the Confusion Assessment Method (CAM-ICU). Stroke and hemorrhage were confirmed by computer brain tomography. Serum biomarker of brain injury S100B protein was measured during the first three days after ICU admission.

Results: Delirium developed in 65 patients (65%). Coma, stroke and hemorrhage developed in 9 patients (9%). Patients who developed brain dysfunction experienced higher S100B levels (p= 0.02), higher cumulative fluid balance (p= 0.01) and higher ICU mortality (p= 0.01) than the patients who did not. Multivariate logistic regression showed that the SOFA score at ICU admission (odds ratio (OR): 1.15, 95% CI [1.05, 1.28], p= 0.004) and the positive cumulative fluid balance during the first five days (OR: 1.09, 95% CI [1.05, 1.021], p= 0.01) were associated with the development of brain dysfunction and delirium.

Conclusions: High positive fluid balance is associated with the development of brain dysfunction in shock patients.

Keywords: Brain dysfunction, Shock, Delirium, Fluid balance, S100B protein
UTILIZATION AND OUTCOME OF EARLY MOBILIZATION PROGRAM IN NEURO INTENSIVE CARE UNIT OF A DEVELOPING COUNTRY

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¹Department of Critical Care, Krishna Institute of Medical Sciences, Secunderabad, India, ²Department of Neurology, Krishna Institute of Medical Sciences, Secunderabad, India

Background/Purpose: To determine utilization and outcome of early mobilization program (EMP) in patients admitted to a neuro intensive care unit (NICU) of a tertiary care centre in India.

Methods: Retrospective analysis of data (January 2014 to January 2015) on critically ill patients with primary neurologic injury admitted to the NICU and referred for EMP was compared to those who were not referred (Controls). Outcomes variables included length of stay in NICU, rate of re-admission to NICU and absolute number of complications related to prolonged hospitalization. Analyses included comparative statistics.

Results: Of 396 patients admitted to NICU, 112 (28.2%) were referred for EMP, with 104 out of 112 patients diagnosed of CVA. Patient characteristics were similar between the groups. The median time from ICU admission to EMP initiation was three days. Patients in EMP group had a mean two days shorter length of stay in NICU (p=0.02); were less likely to be re-admitted to the NICU (p < 0.001). Similarly, patients in the EMP group had decreased number of hospital-acquired pressure ulcer, ventilator-associated pneumonia, depression, and hostility (all p ≤ 0.002). Moreover, the percentage of patients independent for activities of daily living at discharge was higher in EMP group (51% vs 71%; p=0.047).

Conclusions: A multi-disciplinary team-based, resource-efficient EMP is feasible and effective in the NICU of a developing country. Benefits of EMP may have extended impact on the socio-economic burden on patient and care givers. However, efforts are required to increase the utilization of EMP in NICU.

Keywords: Early mobilization program, Neuro intensive care unit
REINFORCING THE FACTS ON THE SOMATIC SURVIVAL OF BRAIN DEAD PATIENTS THROUGH AN OBSERVATIONAL STUDY AT QATAR

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Hamad General Hospital, Qatar

Background/Purpose: Brain death implies the permanent absence of cerebral and brainstem functions. Death of the brain therefore qualifies as death, as the brain is essential for integrating critical functions of the body and the body is reduced to a mere collection of organs. Although the concept of brain death is ethically accepted at our hospital, cultural norms prevent its clinical application.

Methods: Retrospective analysis of brain dead patients admitted to intensive care units at a large urban government hospital at Qatar over a 10 year period from 2003 was done.

Results: 53 patients meeting the brain dead criteria were included in the study. 26% of the patients were from arab countries and 81% of the patients were males. One patient with somatic survival of 395 days post cardiac arrest from Pulmonary embolism, being an outlying variable was excluded from analysis. Mean duration of somatic survival was 4.5 days and the median 3 days. The most common etiology was hemorrhagic stroke (45.3%) followed by ischemic stroke (17%). Ischemic stroke patients had the longest median survival of 11 days. Organ donation was accepted only by 3.7% of patients.

Conclusions: The average somatic survival of brain dead patient is less than a week irrespective of supportive measures provided. Brain death is not immediately followed by cessation of other homeostatic mechanisms. Health care expenditures must include the somatic survival data as intensive care is required. Public education on brain death will assist to incorporate withdrawal of care as a management option and enhance organ donation.

Keywords: Brain death, Survival, Stroke, Organ donation

Table 1: Etiology of Brain dead patients

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracranial Haemorrhage</td>
<td>24</td>
<td>45.3</td>
</tr>
<tr>
<td>Ischemic Stroke</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Traumatic brain Injury</td>
<td>8</td>
<td>15.1</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>5</td>
<td>9.3</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Other Diagnosis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number</th>
<th>Valid Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningoencephalitis</td>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td>Brain tumor with brain stem compression</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Smoke inhalation with diffuse brain edema</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Status asthmaticus</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Astrocytoma with edema</td>
<td>1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Kaplan Meier curve for somatic survival of brain dead patients.
EPIDEMIOLOGICAL, CLINICAL CHARACTERISTICS AND MORTALITY RISK IN CHILDREN WITH SCORPION ENVENOMATION IN QENA GOVERNORATE, UPPER EGYPT: RETROSPECTIVE DATA ANALYSIS

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Background/Purpose: Scorpion envenomation is a life-threatening health problem in tropical and subtropical regions particularly among children. We aimed to describe epidemiological and clinical characteristics and identify predictors of mortality in children with scorpion sting.

Methods: Retrospective analysis of records of paediatric patients with a scorpion sting presented to emergency and intensive care units of General Qena and South Valley University Hospitals between January and December 2013 was done. Epidemiological, clinical, laboratory data and therapeutic interventions were collected and analyzed.

Results: The study included 154 patients, 93 (60.4%) males and 61 (39.6%) females, they were 101 (65.6%) > 6 years old, 42 (27.3%) 2-6 years, 11 (7.1%) < 2 years, 107 (69.5%) from rural areas and 47 (30.5%) from urban areas. Outdoor envenomation occurred in 121 (78.6%) and indoors in 33 (22.4%); at night time in 107 (69.4%) and at day time in 47 (30.6%) patients; sting site was extremities in 140 (90.9) patients and other sites in 14 (9.1%). Thirty one (20.13%) patients died, they had scorpion sting severity class III.

Conclusions: Identification of epidemiological and clinical features of scorpion envenomation in children may supply important data, helping in development of management policies aiming at preventive control of scorpion stings and decrease its mortality.

Keywords: Scorpion, Epidemiological, Children, Mortality
ULTRASOUND IMAGING FOR PEDIATRIC CENTRAL VENOUS CATHETERIZATION; A SYSTEMATIC REVIEW OF OBSERVATIONAL STUDIES AND RCTS

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¹Department of Anesthesia and Intensive Care, Kyoto Prefectural University of Medicine, Japan, ²Emergency and Critical Care Medicine, National Hospital Organization Kyoto Medical Center, Japan, ³Cardiothoracic ICU, National University Hospital, Singapore, ⁴Department of Intensive Care, Erasme University Hospital, Free University of Brussels, Belgium, ⁵Department of Intensive Care Medicine, University Hospital, Kyoto Prefectural University of Medicine, Japan

Background/Purpose: Ultrasound imaging for locating vessels may help percutaneous central venous catheterizations. Earlier systematic reviews of randomized controlled trials (RCTs) highlighted a lack of sufficient information on this topic in pediatrics. The aim of this study was to evaluate its effectiveness and safety in pediatrics by reviewing both non-randomized observational studies and RCTs.

Methods: PubMed was searched in March 2015. We included all studies, regardless of methodology, which compared the success rates of internal jugular or femoral venous cannulations with ultrasound imaging and the anatomic landmark technique. Random-effects meta-analysis was conducted to estimate odds ratios (OR).

Results: Out of 1106 citations, 6 non-RCTs and 9 RCTs enrolling 1711 patients were eligible. Seven RCTs had high risk of bias. In the 6 non-RCTs, the ultrasound imaging showed higher success rates than the anatomic landmark technique (OR 0.35, p < 0.01) and fewer arterial punctures (OR 0.36, p < 0.01). In the 9 RCTs, the ultrasound imaging also showed higher success rates than the landmark technique (OR 0.22, p < 0.01) and tended toward fewer arterial punctures (OR 0.31, p = 0.07). Time to successful cannulation and the number of attempts were reported only in a small number of studies.

Conclusions: Based on this meta-analysis of non-RCTs and RCTs, ultrasound imaging is likely to achieve higher success and fewer arterial punctures than the landmark technique in pediatrics. However, other clinically important questions remain and further studies are needed to determine the impact of ultrasound imaging on relevant outcomes.

Keywords: Ultrasound, Systematic review, Central vein
HYPERTONIC SALINE USE IN CRITICALLY ILL CHILDREN IN EMERGENCY DEPARTMENT (ED)

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Aga Khan University Karachi, Pakistan

Background/Purpose: Three percent hypertonic saline (3% HTS) is a hypersomotic therapy and its use in the treatment of cerebral edema and in brain resuscitation in a variety of brain injury paradigms has increased recently. It improves cerebral perfusion pressure and has immunomodulatory and anti-inflammatory properties. We reviewed the use of hypertonic saline in the emergency department (ED) with hypothesis that HTS improves hemodynamics and Glasgow Coma Scale (GCS) of patients with acute brain injury.

Methods: Children who received intravenous HTS during their stay in the Pediatric ED (PED) from Jan to Dec 2013 were included in study after approval from the ethical review committee. Data collected on pre-designed proforma that included age, gender, diagnosis, indication of hypertonic saline, result of brain imaging and outcome. Hemodynamics, GCS, sodium levels of the patients were monitored before and after 3% HTS therapy. Concentration of HTS was 3% in all the patients and dose was from 3-5ml/kg. Data is presented as frequencies and mean ± SD.

Results: A total of 216 patients received 3%HTS therapy as a part of their initial management in PED as per attending physician. Males were 67.6%, 48% patients were >5 years and 40% were 1-5 years age. Most common diagnosis was Traumatic Brain injury (TBI) in 50.9%, 27% had non traumatic coma. Depressed consciousness was the main indication (51.9%) followed by raised ICP secondary to intracranial bleeding (21.8%). Significant improvement was observed in hemodynamics (p= 0.03) and GCS (0.001) after 3% HTS therapy.

Conclusions: 3% HTS is being increasingly used in pediatric patients with beneficial effects and safe profile. Large multicenter prospective trials are needed.

Keywords: Hypertonic saline, Children, Emergency, Brain injury
CLINICAL PROFILE AND OUTCOMES OF CHILDREN WITH MALIGNANCIES ADMITTED TO THE PEDIATRIC INTENSIVE CARE UNIT OF A RESOURCE-LIMITED SETTING

Mullai Baalaaji, Lalgudi Ganesan Saptharishi, Sunit Singhi, Muralidharan Jayashree, Arun Bansal, Nallasamy Karthi

Division of Pediatric Emergency and Critical Care, Advanced Pediatrics Centre, Post Graduate Institute of Medical Education and Research, India

**Background/Purpose:** To study the clinical profile and outcomes of children with malignancies admitted to the Pediatric Intensive Care Unit (PICU) in a resource-limited setting and to identify independent predictors of PICU mortality.

**Methods:** Retrospective chart review of hospital records of all children, aged 1 month-12 years, with malignancies (excluding brain tumors) admitted to 15-bedded, medical PICU of a large, tertiary care referral center in Northern India, between Jan 2013 and Dec 2014, was done. Data collection proforma designed by experts in intensive care, incorporating demography, oncologic illness, intensive care, sepsis and outcome details, were used. Univariate and multivariate analysis was done to identify independent predictors of PICU-mortality.

**Results:** Baseline characteristics of 98 children with 112 admissions to PICU are described in Table 1. The majority were cases of Acute Lymphoblastic Leukemia and Non-Hodgkin Lymphoma. Fifty-eight children (51.8%) had febrile neutropenia at PICU transfer. Proportion with acute respiratory distress syndrome, shock and acute kidney injury were 8.9%, 47.3% and 27.7% respectively. Nearly 42% required mechanical ventilation and 5.4% required renal replacement therapy. Of the 98 children, 65.2% and 52% survived to PICU and hospital discharge, respectively. On binary logistic regression using 12 predictors, need for ventilation (p<0.001; OR=47.6, 95%CI: 9.2-247) and shock at admission (p=0.001; OR=12.7, 95%CI: 2.7-59.6) were independent predictors of PICU mortality.

**Conclusions:** Nearly two-thirds of children with malignancies requiring intensive care survive to PICU-discharge, underscoring the importance of allocating PICU resources to this group of children, even in resource-limited settings. The sub-group with shock and ventilation requirement had significantly poorer outcomes.

Keywords: Oncologic emergencies, Oncologic intensive care, Malignancy, Resource-limited setting, Outcome predictor
Table 1: Baseline characteristics of the children with malignancies admitted to the pediatric intensive care unit in a resource-limited setting.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean ± SD or Median [IQR] or Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>5.8 [3.1, 9.9] years</td>
</tr>
<tr>
<td>Gender: Male sex, n (%)</td>
<td>84 (85.7 %)</td>
</tr>
<tr>
<td>Duration of cancer therapy prior to PICU admission</td>
<td>2 [0.05, 24.8] weeks</td>
</tr>
<tr>
<td>Primary diagnosis, n (%)</td>
<td></td>
</tr>
<tr>
<td>1. Acute lymphoblastic leukemia</td>
<td>57 (58.2%)</td>
</tr>
<tr>
<td>2. Acute myeloid leukemia</td>
<td>9 (9.2%)</td>
</tr>
<tr>
<td>3. Non-Hodgkin Lymphoma</td>
<td>17 (17.3%)</td>
</tr>
<tr>
<td>4. Hodgkin Lymphoma</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>5. Wilms’ Tumor</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>6. Neuroblastoma</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>7. Others</td>
<td>8 (8.2%)</td>
</tr>
<tr>
<td>Febrile Neutropenia at PICU admission, n (%)</td>
<td>58 (51.8%)</td>
</tr>
<tr>
<td>Indication for PICU transfer, n (%)</td>
<td></td>
</tr>
<tr>
<td>1. Respiratory monitoring/Ventilation</td>
<td>44 (39.3%)</td>
</tr>
<tr>
<td>2. Hemodynamic monitoring/Shock</td>
<td>11 (9.8%)</td>
</tr>
<tr>
<td>3. Neurological</td>
<td>3 (2.7%)</td>
</tr>
<tr>
<td>4. Tumor lysis syndrome</td>
<td>18 (16.1%)</td>
</tr>
<tr>
<td>5. Superior mediastinal syndrome</td>
<td>8 (7.1%)</td>
</tr>
<tr>
<td>6. Multi-organ involvement</td>
<td>28 (25%)</td>
</tr>
<tr>
<td>Length of hospital stay prior to PICU transfer</td>
<td>4 [1, 9] days</td>
</tr>
<tr>
<td>PRISM III score</td>
<td>26 [23, 33.5]</td>
</tr>
</tbody>
</table>

Table 2: Outcomes of children with malignancies admitted to the pediatric intensive care unit in a resource-limited setting:

<table>
<thead>
<tr>
<th>Outcome parameters</th>
<th>Mean ± SD or Median [IQR] or Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion requiring ventilation, n (%)</td>
<td>47 (42%)</td>
</tr>
<tr>
<td>Type of ventilation (n=47)</td>
<td></td>
</tr>
<tr>
<td>1. Invasive (conventional)</td>
<td>43 (91.5%)</td>
</tr>
<tr>
<td>2. Invasive (High-frequency)</td>
<td>3 (6.4%)</td>
</tr>
<tr>
<td>3. Non-invasive ventilation</td>
<td>1 (2.1%)</td>
</tr>
<tr>
<td>Length of ventilation</td>
<td></td>
</tr>
<tr>
<td>28-day ventilator free days (among ventilated cases)</td>
<td>3 [1.6] days</td>
</tr>
<tr>
<td>Proportion requiring vaso-active infusion, n (%)</td>
<td>0 [0.0] days</td>
</tr>
<tr>
<td>Maximum vaso-active inotrope score during PICU stay (n=53)</td>
<td>53 (47.3%)</td>
</tr>
<tr>
<td>Proportion with status epilepticus during PICU stay</td>
<td>90 [45, 130]</td>
</tr>
<tr>
<td>Proportion requiring renal replacement therapy</td>
<td>4 (3.6%)</td>
</tr>
<tr>
<td>PICU-free days (28 day-PICU free survival)</td>
<td>6 (5.4%)</td>
</tr>
<tr>
<td>Proportion of survival-to-PICU discharge</td>
<td>24 [0, 25.8]</td>
</tr>
<tr>
<td>1. Total cohort</td>
<td>73 (65.2%)</td>
</tr>
<tr>
<td>2. Ventilated children (n=47)</td>
<td>11 (23.4%)</td>
</tr>
<tr>
<td>3. Children with shock (n=53)</td>
<td>17 (32.1%)</td>
</tr>
<tr>
<td>Proportion of survival-to-hospital discharge</td>
<td></td>
</tr>
<tr>
<td>1. Total cohort</td>
<td>51 (52.0%)</td>
</tr>
<tr>
<td>2. Ventilated children (n=47)</td>
<td>5 (10.6%)</td>
</tr>
<tr>
<td>3. Children with shock (n=53)</td>
<td>12 (22.6%)</td>
</tr>
</tbody>
</table>
CHANGING ETIOLOGY AND PREDICTORS OF OUTCOME IN CHILDREN WITH ACUTE CNS INFECTIONS: A PROSPECTIVE HOSPITAL-BASED STUDY

Sunit Singhi1, Pratibha Singhi1, Ritu Aggarwal2, Karthi Nallasamy1

1Department of Pediatrics, Postgraduate Institute of Medical Education and Research, India, 2Department of Immunopathology, Postgraduate Institute of Medical Education and Research, India

Background/Purpose: We conducted this study to identify the etiological trend and predictors of outcome in children with acute CNS infections after the introduction of Hib and pneumococcal vaccines in the community.

Methods: In this prospective ongoing observational study, conducted in a tertiary care center between July 2013 and February 2014, we enrolled consecutively children aged 3 months to 14 years with clinical and CSF features of acute CNS infection. Outcomes were assessed at discharge and after 6 months using POPC/PCPC scales; predictors were identified using multivariate regression.

Results: The mean (SD) age of 100 children enrolled was 4.2 (3.5) years. At presentation, convulsions were seen in 71 (14 were in status epilepticus) and Glasgow Coma Score (GCS) ≤8 in 36 children. Etiological diagnosis could be made in 65 children; 37 had acute bacterial meningitis [scrub typhus-13, H.influenzae-7, S.pneumonia -4] and 28 had viral meningoencephalitis [Japanese encephalitis (JE) -13, Herpes simplex-7, dengue-1]. Hypoalbuminemia, elevated CRP, CSF cell count >100/mm3 and glucose <40mg/dl were associated with a diagnosis of bacterial meningitis. 54 children survived without neurological deficit, 35 had neurological deficit (27% in bacterial vs 61% in viral etiology) at discharge, 5 discontinued care and 6 died. At 6 months, 69 had good neurological outcome, 8 had poor neurological outcome and 3 children died. Viral etiology, GCS ≤8 and serum sodium level predicted outcome.

Conclusions: JE virus remains the commonest cause of encephalitis while Scrub typhus is a significant, hitherto under-recognized etiology of acute CNS infections in children. Admission GCS and serum sodium predicted outcome.

Keywords: CNS infections, Meningitis, Encephalitis, Outcome
HIGHER CENTRAL VENOUS PRESSURE IS ASSOCIATED WITH DEVELOPMENT OF ACUTE KIDNEY INJURY IN SEPTIC PEDIATRIC PATIENTS

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National Center for Child Health and Development, Japan

Background/Purpose: The relationship between hemodynamic parameters with development of septic acute kidney injury (AKI) has not been fully elucidated. The purpose of this study is to investigate the association between systemic hemodynamics and AKI in septic children.

Methods: A retrospective study between 2011 and 2013 was performed in a pediatric ICU. AKI was defined as development of stage I or higher of AKI, based on the Kidney Disease Improving Global Outcomes (KDIGO) criteria, between the second and sixth day of ICU admission. We studied the association between the following hemodynamic parameters within 48 hours of admission and AKI: central venous pressure (CVP), systolic, mean and diastolic arterial pressure (SAP, MAP and DAP), and, central venous oxygen saturation (ScvO2).

Results: 84 pediatric patients were identified during the study period. The age of the patients varied from 0 to 182 months (median: 20 months). Of these, 26 had AKI of stage I and higher. AKI patients had higher rate of prolonged capillary refill time (CRT) (67% vs. 38%, P < 0.001) and use of epinephrine (46% vs. 10%, P = 0.0006) than those without AKI. SAP, MAP, DAP and ScvO2 were not significantly different between the groups. Patients with AKI had higher CVP (9.4 vs. 7.1 mmHg, P = 0.02) and higher percent fluid overload in the first two days (P = 0.0007).

Conclusions: Association between elevated CVP and AKI suggests a role of venous congestion in the development of AKI. The targeting high CVP may increase the occurrence of AKI in septic children.

Keywords: Septic AKI, Children, CVP, Percent fluid overload
AN INTERNATIONAL NATIONAL EMERGENCY AIRWAY REGISTRY FOR CHILDREN: COMPARISON OF TRACHEAL INTUBATION PRACTICES ACROSS INTERNATIONAL PICUS

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Background/Purpose: Tracheal intubation (TI) is a common, life-saving intervention in pediatric intensive care units (PICUs). There is heterogeneity in approaches to TI across PICUs. This variation may be more marked across different geographical regions, and may lead to difference in safety outcomes. We hypothesized there would be differences in the process of care and safety outcomes for TI across PICUs in 4 different geographical regions (Japan, New Zealand, Singapore, and North America).

Methods: The multicenter TI safety database: National Emergency Airway Registry for Children (NEAR4KIDS) expanded to include international PICUs since 2012. Currently, there are three international PICUs outside of North America. We analyzed data from the NEAR4KIDS database from 3 PICUs (1 in Japan, 1 in New Zealand and 1 in Singapore) from January 2013 to September 2014 and compared against North America (25 ICUs). We included all initial TI courses performed in PICUs. Outcome measures included adverse tracheal intubation associated events (TIAEs) and severe TIAEs (e.g., cardiac arrest, aspiration, esophageal intubation not immediately recognized). Univariate analysis was performed with χ² test and Kruskal-Wallis test, with P < .05 taken as statistical difference.

Results: We identified a total of 515 TIs across the 3 international PICUs. Median age of patients (years) was 0 (IQR 0-1) in Japan, 0 (0-1) in New Zealand, and 1 (0-5) in Singapore, significantly different (p=0.005). The most common TI indication was respiratory failure (74% in Japan, 62% in New Zealand, 68% in Singapore, p=0.17), similar to TIs from North America (62%). Direct laryngoscopy was the most common TI method in both international and North America (96% vs. 85%, p<0.001). International PICUs used uncuffed tracheal tube more often (62% vs. 7%, p<0.001). Among the reported TIs, tube change was more common in international sites (36% vs. 12%, p<0.001). The occurrence of adverse TIAE was 20% in Japan, 14% in New Zealand, and 10% in Singapore, not different from North America (International 15% vs. North America 16%, p=0.64). The occurrence of severe TIAEs was 11% in Japan, 6% in New Zealand, and 2% in Singapore, not different from North America (International 7% vs. North America 6%, p=0.73).

Conclusions: NEAR4KIDS TI registry successfully captured similarities and differences in TI practice and outcomes across international PICUs. International sites used uncuffed tracheal tube more often, and had higher proportion of tracheal tube change. The occurrence of TIAE and severe TIAEs were similar between international and North American sites.

Keywords: Intubation, Pediatric, Respiratory failure, Database
THE RENAL EFFECT OF PROPHYLACTIC AMINOPHYLLINE THERAPY AFTER CARDIAC SURGERY IN INFANTS

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Background/Purpose: Acute kidney injury (AKI) after pediatric cardiac surgery remains an important complication. Aminophylline, well established bronchodilator, is also considered to be an effective diuretic and anti-inflammatory agent. We evaluated the effect of prophylactic aminophylline treatment after cardiac surgery in infants.

Methods: From Jan 2011 to Dec 2014, 58 infants under 3 months of age who underwent operation for isolated ventricular septal defect were included and were classified to the prophylactic aminophylline therapy group (AMP group, N=35) and the control group (N=23). This is a retrospective analysis of urine output, fluid overload and duration of oliguria/anuria between 2 groups in the postoperative period.

Results: There was no statistical difference of age, body weight and height between the groups. During 96 hour study period, increase of daily urine cumulative was higher in the AMP group after surgery than the control group. The serum creatinine level in AMP group was also significantly decreased at all times after surgery compared to the preoperative period (P<0.001). There were no complications related to aminophylline administration.

Conclusions: We suggest that administration of aminophylline could promote to increase urine output in the immediate postoperative period. The prospective studies are necessary to confirm the safety and effectiveness of prophylactic application.

Keywords: Pediatric cardiac surgery, Infant, Acute kidney injury
RECENT CLINICAL OUTCOME IN CHILDREN WITH ACUTE FULMINANT MYOCARDITIS SUPPORTED BY MECHANICAL CIRCULATORY SUPPORT

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Background/Purpose: The clinical outcome of severe acute myocarditis children who require mechanical circulatory support is not well known. We studied the survival and clinical courses of patients with acute fulminant myocarditis supported by extracorporeal membrane oxygenation (ECMO).

Methods: We performed a retrospective chart review of 12 consecutive children with acute fulminant myocarditis who were treated with ECMO between April 2013 and January 2015.

Results: The median age and body weight was 25.8 months (range, 2.9 months to 11.5 years) and 10.3 Kg (range, 5.3 to 47.5 Kg), respectively. All the patients received ECMO procedure via peripheral approach. The median ECMO duration was 140 hours (range, 51 to 425 hours). Viral pathogens were detected in seven patients. Five patients underwent left side of the heart decompression procedure using catheter-based technique, which is composed of atrial septostomy and leaving a left atrial venting cannula. All the patients had successful weaning of ECMO. Eleven patients (91.7 %) survived to discharge. Of these patients, ten recovered ventricular function and one patient underwent successful orthotopic heart transplantation. The dead patient with a successful weaning of ECMO chose to donate other organs due to unrestored brain function by enterovirus encephalitis. Major complications developed in two patients. One patient developed intracardiac thrombosis and received emergency thrombectomy. The other patient had a left side weakness due to a right basal ganglia infarction.

Conclusions: In children with acute fulminant myocarditis, mechanical circulatory support using ECMO can be a first-line treatment with excellent results.

Keywords: Myocarditis, Extracorporeal membrane oxygenation
COMPARISON OF ENTERAL VERSUS INTRAVENOUS POTASSIUM SUPPLEMENTATION IN HYPOKALEMIA IN POST CARDIAC SURGERY PEDIATRIC CARDIAC INTENSIVE CARE PATIENTS PROSPECTIVE OPEN LABEL RANDOMIZED CONTROL TRIAL

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Background/Purpose: Although intravenous potassium replacement (IVPR) in hypokalemia is preferred route, it is associated with serious adverse effects. Enteral potassium replacement (EPR), with its superior safety profile, may be a better alternative to IVPR. Primary Objective was to compare efficacy of EPR and IVPR for management of hypokalemia. Secondary objectives included comparison of adverse effects and comparison of the number of doses required to achieve resolution of the episode of hypokalemia.

Methods: Study was conducted at Pediatric Cardiac Intensive care Unit (PCICU) at Aga Khan University, Karachi. 41 post-cardiac surgery patients (1 month to 25 years) admitted to PCICU were recruited for the study (23 IVPR arm and 18 EPR arm). Intervention arms were block randomized as alternate week for IVPR and EPR. Recruited patients received treatment accordingly.

Results: Both groups (41 patients) had similar baseline characteristics. Mean age was 4.7 (SD +/-4) years and most common surgical procedure was VSD repair (12 patients 29.3%). No mortality was observed in either of arms. However, 4 episodes of vomiting and one arrhythmia were seen in EPR group. After adjusting for age, potassium concentration at the beginning of the episode, average urine output, inotropic score and diuretic dose, there was no statistically significant difference in change in potassium levels after enteral and intravenous replacement both by intention to treat (p=0.86) and actual treatment (p=0.39) analysis.

Conclusions: There is no difference in EPR or IVPR in treating hypokalemia and EPR may be an equally efficacious alternative to treat hypokalemia in post-operative congenital heart disease patients.

Keywords: Hypokalemia, Potassium replacement, Pediatric post
Figure 1: Recruitment flow chart EIPS. *Patients who developed vomiting and GI upset and could not tolerate enteral feeding or developed critically low potassium levels.

<table>
<thead>
<tr>
<th></th>
<th>Intention to treat (ITT)</th>
<th>Actual treatment received (AT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IV K (n=18)</td>
<td>Oral K (n=23)</td>
</tr>
<tr>
<td>Episode per child</td>
<td>2.7±2.1</td>
<td>2.1±1.3</td>
</tr>
<tr>
<td>Event per episode</td>
<td>5.0±4.9</td>
<td>4.6±4.2</td>
</tr>
<tr>
<td>Mean change in Potassium</td>
<td>0.82±0.7</td>
<td>0.86±0.8</td>
</tr>
<tr>
<td>Percentage change in Potassium</td>
<td>0.24±0.2</td>
<td>0.26±0.3</td>
</tr>
</tbody>
</table>

All values reported as Mean ±SD
1- Change in potassium concentration calculated as 'last event K-first event K' of an episode
2- Relative percent change calculated as (previous K-current K)/previous K * 100
Safe and effective PIC (2)  

ORAL PRESENTATION

59612th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

RESCUE BRONCHOSCOPIC INTUBATION USING BENTSON EXTRA-FLOPPY GUIDEWIRE VIA LARYNGEAL MASK AND SELDINGER TECHNIQUE IN CRITICAL CARE SETTING

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Background/Purpose: Intubation of grade 3 or 4 airway can be challenging especially in the critical care setting where there is no option of deferment. Flexible bronchoscopy offers a safe intubation tool when used in conjunction with LMA to maintain oxygenation and ventilation. Reports suggest standard airway guidewires may be a risk for pneumothorax. We report our use of the Bentson extrafloppy guidewire to minimise this risk as its distal end is atraumatic. We have a PICU-led bronchoscopy service and report on the use and safety of this method in airway emergencies since 2005.

Methods: We retrospectively reviewed 1369 bronchoscopic procedures (2005-2015) performed by the PICU bronchoscopy team, searching for Difficult Airway and use of LMA and guidewire to facilitate intubation. A 2.8mm Olympus BXP260F scope was used and a Bentson cerebral 0.35inch guidewire passed through the suction channel, over which an appropriately sized Cook airway exchange catheter could be passed via Seldinger technique.

Results: Eleven patients required 13 bronchoscopic procedures for emergency intubation (weight range 4-40kg) for Grade 3 or 4 airway. All patients were intubated successfully using this method on first bronchoscopic attempt, despite previous failed intubations. One patient received CPR for hypoxic bradycardia following failed intubation attempts prior to LMA insertion. The procedure was well tolerated without complication.

Conclusions: The Bentson cerebral guidewire provides a safe and reliable method to perform the Seldinger guidewire intubation on the paediatric airway in emergency settings. As it is intensivist-led, we are able to perform this procedure safely and rapidly in patients with unanticipated difficult airways.

Keywords: Airway, Bronchoscopy, PICU, Seldinger
EPINEPHRINE IS MORE LIKELY TO ACHIEVE THERAPEUTIC END-POINTS WITHIN FIRST HOUR THAN DOPAMINE IN FLUID-REFRACTORY PEDIATRIC SEPTIC SHOCK

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Background/Purpose: We compared efficacy of dopamine and epinephrine as first-line vasoactive therapy in achieving therapeutic end-points within the first hour of resuscitation in fluid-refractory hypotensive cold septic shock.

Methods: Children with fluid-refractory hypotensive shock were randomized in a double-blind manner to receive either epinephrine (0.1-0.2-0.3 μg/Kg/min) or dopamine (10-15-20 μg/Kg/min) as first-line vasoactive agent till systolic BP > 5th percentile, normal heart rate for age, urine output > 1 ml/kg/hr, CFT < 3 sec and normal mental status. After achieving maximum doses of test drugs, open-label vasoactive were started as per physician discretion. IEC approved the study. Written consent was obtained.

Results: We enrolled 29 children in epinephrine group and 31 in dopamine group. Median (IQR) age and PRISM III were 7 (1-11) years and 11 (5-16) in epinephrine group; and 4 (0.8-8) years and 11 (5-16) in dopamine group. Epinephrine achieved therapeutic endpoints within the first hour in a greater proportion of children than dopamine (41% versus 13%; RR-3.2, 95%CI: 1.16-8.82, p=0.019), the trend persisted even at 6 hours (48.3% versus 29%, RR-1.5, 95%CI: 0.9-2.5, p=0.184). Median (IQR) SOFA score on day-3 was lower in epinephrine group (8, 2-13 versus 12, 6-14, p=0.053). MAP, pH, arterial lactate and ScvO2 at 24 hours were not significantly different between the groups. There were no significant differences observed in length of PICU stay and hospital stay, day-28 all-cause-mortality, adverse events and nosocomial infection.

Conclusions: Epinephrine is more effective than dopamine for achieving end-points of resuscitation within the first hour and improves organ functions.

Keywords: Septic shock, Fluid-refractory, Dopamine, Epinephrine, Pediatric
Poster Presentation
LIPID EMULSION ATTENUATES CARDIOVASCULAR COLLAPSE INDUCED BY TOXIC DOSE OF VERAPAMIL

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Background/Purpose: Lipid emulsion (LE) has been used for the treatment of systemic toxicity induced by several drugs without specific antidotes. One of the proposed underlying mechanisms of the LE treatment is the lipid sink theory, which states that toxic doses of lipid-soluble drug can be extracted from tissue using LE. The goal of this study was to examine the effect of LE on toxic dose calcium channel blocker-cardiovascular collapse in the isolated vessels and in an in vivo animal model. In decreasing order of lipid solubility, the calcium channel blockers are as follows: bepridil, verapamil, nifedipine, and diltiazem. Based on previous reports, we tested the hypothesis that LE would attenuate calcium channel blocker-induced cardiovascular depression in a lipid solubility-dependent manner.

Methods: In isolated endothelium-denuded aortas precontracted with 10-7 M phenylephrine, calcium channel blocker (bepridil, verapamil, nifedipine, and diltiazem) concentration-response curves were generated in the presence or absence of Intralipid. We assessed the effect of Intralipid on the hemodynamic change induced by continuous infusion of toxic-dose verapamil or diltiazem.

Results: The magnitude of the Intralipid-mediated inhibition of toxic dose calcium channel blocker-induced vasodilation was as follows: bepridil > verapamil > nifedipine > diltiazem (Fig. 1). Intralipid attenuated the decreased systolic blood pressure induced by toxic dose of verapamil (Fig. 2A), whereas Intralipid had no effect on the decreased systolic blood pressure induced by toxic dose of diltiazem (Fig. 2B).

Conclusions: Intralipid attenuated toxic dose verapamil-induced cardiovascular collapse, and this effect appears partially associated with the lipid solubility of calcium channel blockers.

Keywords: Lipid emulsion, Verapamil, Systemic toxicity
THE ASSOCIATION BETWEEN BACTERIAL TRANSLOCATION AND FLAGELLIN

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Background/Purpose: Bacterial translocation (BT) is the invasion of indigenous intestinal bacteria through the gut mucosa to normally sterile tissues and the internal organs. In severe cases of BT, patients can easily develop sepsis; therefore, the prevention of BT is very important. Bacterial flagellin is a known toll-like receptor 5 (TLR5) agonist and is prevalent in the gut; however, its role has not yet been elucidated. In this study, we examined whether bacterial flagellin affects BT.

Methods: Cultured rat intestinal epithelial cells (IEC6 cells) were seeded in each dish. We performed a wound healing assay and Western blotting. For the wound healing assay, phase contrast microscopy images were taken at the time of wounding (0 h) and after 16 h and 24 h.

Results: Taking each initial wound area as 100%, in the absence and presence of flagellin, 39.9 ± 3.3% and 13.4 ± 4.7% of the initial wound remained, respectively (P < 0.01) (Figure 1). Flagellin was statistically significantly shown to promote wound healing in IEC6 cells. Western blotting showed that flagellin-stimulated IEC6 cells exhibited increased α-smooth muscle actin levels and phosphorylation of heat shock protein 27, which are known intercellular adhesion markers.

Conclusions: TLR5 stimulation by flagellin promotes wound healing and tight intercellular adhesion. Therefore, flagellin is considered to lead to suppression of BT.

Keywords: Bacterial translocation, Flagellin, Wound healing
IDENTIFYING PULMONARY ENDOTHELIAL GLYCOCALYX OF MURINE SEPSIS MODEL USING INTRAVITAL MICROSCOPY

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Background/Purpose: Direct pulmonary capillary imaging in cellular level could increase the depth and scope of current understanding of sepsis-induced ALI. However, conventional intravital microscopy approach for the lung has been limited due to severe motion-artifact induced by normal physiological movement of the lung and the heart. We newly implemented a custom design lung imaging window device integrated to a modified intravital microscopy system and investigated pulmonary microcirculatory alteration of glycocalyx in sepsis in vivo.

Methods: C57BL/6J mouse was divided into two groups (Control / CLP). At 24 hours after CLP procedure, both groups of mouse were anesthetized, intubated and mechanically ventilated. After performing thoracotomy, we applied suction device combined with lung window on the lung surface for local motion stabilization. By utilizing a custom-design video-rate laser scanning confocal microscopy system, we acquired dynamic cellular-level microscopic images of lung. Fluorescence angiography with FITC-dextran dye and RBC exclusion imaging analysis were performed to identify endothelial surface layer representing glycocalyx in vivo.

Results: Width of endothelial surface layer of CLP group (0.532±0.179 μm) was much narrower than control group (1.715±0.082 μm). The significant difference of endothelial surface layer width has been found out (P < 0.00134, Mann-Whitney test).

Conclusions: Endothelial glycocalyx which represents barrier of endothelial cell was identified by using a modified intravital microscopy system for dynamic lung imaging. Implication of our model will enhance future research in pathophysiology and treatment strategy of sepsis-induced ALI.

Keywords: Sepsis, ALI, Intravital microscopy, Glycocalyx
COMBINATION THERAPY OF NIACIN AND SELENIUM ATTENUATES BRAIN INJURY AND IMPROVES NEUROLOGICAL OUTCOME AFTER CARDIAC ARREST IN RATS

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Background/Purpose: Ischemia-reperfusion injury after cardiac arrest induces oxidative stresses and glutathione redox cycle is an endogenous antioxidant defense. We performed this study to examine whether the combination therapy of clinically relevant doses of niacin and selenium attenuates brain injury and improves neurological outcome after cardiac arrest in rats.

Methods: Ventricular fibrillation was induced in rats. After 6 minutes of no flow time, cardiopulmonary resuscitation was provided and return of spontaneous circulation (ROSC) was achieved. Animals were then administered vehicle, 360 mg/kg of niacin, 60 μg/kg of selenium, or niacin plus selenium, respectively. Neurologic deficit scales were scored at 24, 72 hours, and 7 days post-ROSC. Then, a separated set of animals was sacrificed at 72 hours post-ROSC and brain tissues were harvested.

Results: The combination therapy of niacin and selenium attenuated cellular apoptosis and neuronal damage in hippocampal cornu ammonis 1 region and reduced neurologic deficits. The combination therapy of niacin and selenium decreased malondialdehyde level, the phosphorylations of p38 and c-Jun N-terminal kinase/stress activated protein kinase (JNK), and the cleavage of caspase 3 in brain tissues. However, individual therapy of niacin or selenium failed to do so. Niacin increased reduced glutathione (GSH) level and selenium increased glutathione peroxidase activity.

Conclusions: The combination therapy of clinically relevant doses of niacin and selenium activated the glutathione redox cycle, reduced lipid peroxidation, suppressed the mitogen-activated protein kinase pathway, attenuated brain injury, and improved neurological outcome after cardiac arrest in rats.

Keywords: Cardiac arrest, Antioxidants, Glutathione, Mitogen-activated protein kinase
COMPARISON OF CD64 LEVELS PERFORMED BY THE FACS AND ACCELLIX SYSTEMS

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Background/Purpose: Medical flow cytometry (FACS) provides diagnostic answers by detecting the presence and concentration of cell populations, and/or by measuring concentrations of cell surface markers expressed on cells. Currently, FACS is limited to high complexity laboratories with time consuming pre-analytical steps, requiring trained technologists available only during business hours. The Accellix table top flow cytometer automates the process with results available within 20 minutes. Sample preparation and reading are performed in a dedicated disposable cartridge. Analytical data processing utilizing proprietary algorithms provides answers directly to the user.

Methods: The Accellix disposable cartridge-based platform implements sample preparations using three reagent blisters. The three Accellix CD64 cartridge blisters contain staining cocktail of conjugated monoclonal antibodies, lysis buffer and reference beads respectively. Once a sample processing is complete, the sample flows through a dedicated reading channel where data is acquired. The present study compared the results of neutrophil CD64 levels performed by standard laboratory FACS and the Accellix system in ICU infected and control patients and normal volunteers.

Results: In a demonstration of cell surface marker quantitation a comparison study of 118 blood samples showed a correlation coefficient of 0.94 for Accellix determined neutrophil CD64 compared to those determined using a FACS. The comparison of the CD64 levels performed by the FACS and the Accellix system is shown in the figure.

Conclusions: The cartridge-based Accellix system determined CD64 levels which were comparable to standard laboratory FACS. Accellix is a promising new system which may help quickly diagnose infection in critically ill patients.

Keywords: CD64 levels, Flow cytometry, ACCELLIX system
A COMPARISON OF LPS MEASUREMENT BY EAA AND LAL IN AN LPS-INDUCED PIG MODEL

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Background/Purpose: Measurement of the concentration of LPS is commonly performed by turbidimetric limulus amebocyte lysate (LAL) assay. Recently, an LPS assay, endotoxin activity assay (EAA) has been reported. Although there are mixed opinions regarding EAA, EAA has been approved by the FDA and is used as criteria in EUPHAS 2 and EUPHRATES trials. In clinical studies, both assays have been compared. However, there have been no reports in pigs. Therefore, we compared EAA with LAL in an LPS-induced pig model.

Methods: Pigs were bolus administrated with 8 mcg/kg LPS by intramuscular injection (IM). Eighteen hours after IM, 10 mcg/kg continuous intravenous infusion (IV) was started for 30 minutes under anesthesia (n=3). Blood samples were collected before LPS IV and at 60 and 120 minutes after LPS IV. LPS levels were measured by both LAL and EAA.

Results: Using LAL, LPS levels were 595.7±303.4 mcg/kg before injection, 1164.0±599.9 mcg/kg at 60 minutes, and 425.0±180.1 mcg/kg at 120 minutes. However, EAA was not able to detect LPS level.

Conclusions: There was a relationship between LAL data and LPS administration. EAA, however, could not measure LPS activity levels. LAL measures LPS concentration using turbidity change in gel-clotting in the LAL-endotoxin reaction. EAA measures LPS activity by stimulation of the neutrophil respiratory burst via complement opsonized murine LPS-IgM complexes and emission of light via reaction of oxidants with luminal. Therefore, this suggests that murine antibodies do not react to swine complements or neutrophils. The data showed that LPS measurement by EAA might be affected by animal species.

Keywords: Pigs, LPS, Limulus amebocyte lysate, Endotoxin activity assay, Neutrophil
EFFECT OF ENDOTOXIN REMOVAL ON FECAL PERITONITIS OF CANINE SEPSIS MODEL

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Background/Purpose: Polymyxin B-immobilized fiber hemoperfusion (PMX) is known to be beneficial not only to remove endotoxin but also to modulate immune function. We have induced experimental canine polymicrobial peritonitis and evaluate therapeutic effects of PMX in the aspect of clinical and immunological data.

Methods: Ten healthy beagle dogs were included in this study. Experimental polymicrobial peritonitis was induced by intraperitoneal injection of autologous feces. Animals were treated with canine early goal-directed therapy protocol and peritoneal irrigation. PMX hemoperfusion was initiated at 3 hours after septic insult using an absorbent column at a flow rate of 50-100mL/min. Physiologic parameters, laboratory and immunologic analysis (endotoxin quantification using Limulus Amebocyte Lysate assay, TNF-α, IL-6, IL-10 and flow cytometry analysis of lymphocyte subset using CD21, CD3, CD4, CD5, and CD8 antibodies).

Results: Mean survival time was 13.6h and 28.6h for control group and PMX group respectively. The mean arterial blood pressure gradually decreased below 65 mmHg with compensatory tachycardia for both group but the peak time of tachycardia and the incidence of septic shock were delayed or absent in PMX group. For immunologic analysis, PMX was beneficial to decrease plasma endotoxin levels. Lymphocyte subsets were not significantly different but proinflammatory cytokine concentrations were decreased after PMX hemofiltration.

Conclusions: Endotoxin removal by abdominal irrigation and PMX hemoperfusion therapy on fecal peritonitis-induced sepsis has beneficial effects on survival time and progression rate of septic shock. This effect may be due to the continuous removal of endotoxin, which yield immunomodulation in a canine polymicrobial peritonitis model.

Keywords: Sepsis, Hemoperfusion, Polymyxin B adsorption filter
LOW AND HIGH MIXED VENOUS OXYGEN SATURATION VALUES ARE ASSOCIATED WITH INCREASED ARTERIAL LACTATE DURING ENDOTOXIC SHOCK

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Background/Purpose: Central venous oxygen saturation (ScvO2) higher than 70% has been recommended during resuscitation of septic shock. However, its clinical value has been questioned by recent studies. At the same time, it was shown that high levels of ScvO2 could also indicate impaired tissue oxygenation. Objective: To investigate SvO2 and arterial lactate changes in an endotoxic shock experimental model.

Methods: Endotoxic shock was induced by E.coli lipopolysaccharide (LPS) in a porcine model under i.v. analgesia and anesthesia. The protocol was approved by the Institutional Animal Research Committee. Animals were randomly assigned to different study groups: Sham, LPS without treatment, and LPS + hemodynamic resuscitation. Monitoring was implemented hourly during 240 minutes. Delta mixed venous oxygen saturation from baseline (deltaSvO2) was calculated along with systemic hemodynamic parameters and arterial lactate. A 3 % change either below or above baseline SvO2 was defined to classify deltaSvO2 as Low or High.

Results: From 150 pairs of data, 33 % of deltaSvO2 values were Low, while 33 % were defined as Higher than baseline. The mean values were -14.4 (8.6), 11.3 (7.6), and 0.02 (0.9) % for the Low, High and Baseline deltaSvO2 respectively. Mean arterial lactates were 3.25 (2.4), 2.83 (1.9), and 1.78 (1.3), mmol/L for the same groups (p<.05).

Conclusions: Either Low or High SvO2 values may indicate impaired tissue oxygenation during endotoxic shock. The combined measurement of arterial lactate and SvO2 could contribute to identify metabolic dysfunctions and may announce organ failure.

Keywords: Endotoxic shock, Arterial lactate, Central venous oxygen saturation, Mixed venous oxygen saturation
CYCLING OFF CRITERIA AND ITS EFFECTS IN PATIENTS RECOVERING FROM ACUTE RESPIRATORY FAILURE

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Background/Purpose: To observe the effects of cycling off criteria (COC) on respiratory parameters of patients recovering from acute respiratory failure (ARF).

Methods: Forty stable patients were evaluated. Chronic Obstructive Pulmonary Disease patients were excluded. All patients were ventilated in pressure support ventilation between 10 and 12 cmH2O Positive end-expiratory pressure was kept in 5 cmH2O, fraction of inspired oxygen was set until 40%. COC was set at 5%, 25%, 50% and 70%, for a 5-minute period each. Respiratory rate, frequency / tidal volume ratio (f/Vt ratio), tidal volume, Minute volume, SpO2, and Ti/Ttot were measured at each percentage of COC. Analysis of variance for repeated measures was used to analyze variations during the four COC. The Bonferroni test was used to identify which values were significantly different among the multiple comparisons. A probability of less than 0.05 was considered significant. The ventilators used were the Vela - Care Fusion (Figure 1).

Results: All respiratory parameters presented significant variations when the comparisons were made from 5% to 50% or 70% of COC (P =0.0001). No respiratory parameter presented significant variations when the comparisons were made from 5% to 25% of COC. Changes on f / Vt ratio are shown in table 1.

Conclusions: In patients recovering from ARF, the use of COC at 5% or 25% has no effect on the respiratory parameters. The increase of COC to 50% or more can lead to respiratory distress, suggesting that these values should be avoided in this population.

Keywords: Mechanical ventilation, Respiratory failure, Respiratory parameter
NONINVASIVE VENTILATION IN MILD TO MODERATE ACUTE RESPIRATORY DISTRESS SYNDROME: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background/Purpose: Single studies of Noninvasive Ventilation (NIV) in the management of early acute respiratory distress syndrome (ARDS, 100 mmHg ≤ PaO2/FiO2 ≤ 300 mmHg) have produced controversial findings. The aim of this study is to critically review the literature to investigate whether NIV reduces intubation rate, intensive care unit (ICU) mortality and hospital mortality compared to high-concentration oxygen therapy.

Methods: We performed a systematic review and meta-analysis of randomized controlled trials by searching PubMed, EMBASE, Cochrane library, Ovid Medline and bibliographies of articles retrieved (inception to July 2014). We screened for relevance studies that enrolled adults who developed mild to moderate ARDS of various etiologies and were treated with NIV. We included studies reporting at least one clinical outcome of interest to perform a meta-analysis.

Results: Six studies (239 patients) met the inclusion criteria and were incorporated in the meta-analysis. All studies reported intubation rates. The results were quite heterogeneous across studies, with a summary odds ratio of 0.53 (95% CI= 0.31-0.91; p=0.02) for patients treated with NIV compared to oxygen therapy. Whole ICU mortality of NIV held no advantage over oxygen therapy (Odds Ratio, 0.74; 95% CI= 0.50-1.10; p=0.14). The subgroup meta-analysis showed that the application of bi-level positive support ventilation (BiPAP) was associated with a significant reduction in ICU mortality (Odds Ratio, 0.57; 95% CI= 0.32-0.99; p=0.05). Hospital mortality of NIV held also no advantage over oxygen therapy (Odds Ratio, 0.39; 95% CI= 0.14-1.08; p=0.07).

Conclusions: These results suggest that NIV could reduce intubation rate in the management of mild to moderate ARDS.

Keywords: Noninvasive ventilation, ARDS
ENDOCAN CAN DEFINE PROGNOSIS IN ACUTE RESPIRATORY DISTRESS SYNDROME

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Background/Purpose: Endocan is a proteoglycan preferentially expressed in the pulmonary vasculature. We sought to determine whether plasma endocan levels could help to predict outcome in ARDS patients.

Methods: All admissions to our department of intensive care over a 150-day period were screened to identify patients who fulfilled ARDS criteria (using the Berlin definition). Endocan concentrations were measured at the time of ARDS diagnosis (T0) and the next morning (T1). We compared data from survivors and non-survivors and from survivors with <10 days of ventilator support (GOOD EVOLUTION) and those who either died or needed >10 days of mechanical ventilation (POOR EVOLUTION).

Results: We enrolled 96 consecutive ARDS patients [median APACHE II score 21, SOFA score 9, PaO2/FiO2 ratio 155(113:206)]. Two-thirds of the patients had sepsis and 53% needed norepinephrine. Non-survivors were older (66±15 vs 59±18 years, p=0.045), had higher APACHE II scores [27(22:30) vs 20(15:24), p<0.001] and blood lactate levels [2.1(1.3:4.0) vs 1.5(0.9:2.6), p=0.024], but similar PaO2/FiO2 ratios [150(116:207) vs 158(110:206), p=0.95] than survivors. At T0, endocan levels were similar in survivors and non-survivors [8.8(7.5:16.7) vs 8.1(6.0:10.3), p=0.124] and in patients with GOOD and POOR EVOLUTION [8.5(7.2:14.1) vs 8.3(6.0:11.0), p=0.472]. At T1, levels were significantly higher in patients with POOR than in those with GOOD EVOLUTION [12.0 (6.8:18.6) vs 7.2 (5.4:12.5), p=0.007] and tended to be higher in non-survivors than in survivors [9.7(6.8:18.6) vs 8.4(5.8:13.9), p=0.06].

Conclusions: Blood endocan concentrations on the first day after diagnosis can help predict outcome (mortality or prolonged mechanical ventilation) in patients with ARDS.

Keywords: Acute respiratory failure, Prognosis, Endothelium
COUGH AUGMENTATION TECHNIQUES IN THE CRITICALLY ILL: A NATIONAL SURVEY

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Background/Purpose: Cough augmentation techniques (CAT) (mechanical insufflation-exsufflation (MI-E); manually assisted cough (MAC); lung volume recruitment (LVR)) used to manage respiratory complications of neuromuscular disease may improve outcomes for critically ill patients with acute respiratory failure. Our objective was to describe prevalence of CAT use, indications, contraindications, interfaces, settings, complications, and barriers to use.

Methods: Email survey to nominated local champion in all (except Quebec) Canadian units (ICUS, weaning centres, intermediate care) managing prolonged mechanical ventilation with telephone and email reminders.

Results: Survey response rate was 139/208 (67%); 67/139 (48%) units used CAT. 44 (66%) units used MI-E, 44 (66%) MAC, and 51 (76%) used LVR (manual resuscitation bag and one-way valve). Secretion clearance was the most common indication (MI-E 95%, MAC 85%, LVR 81%). Weaning from invasive (MI-E 24%, MAC 43%, LVR 32%) and non-invasive ventilation (MI-E 19%, MAC 25%, LVR 21%) were infrequent indications. CAT use by diagnosis is shown below. Pneumothorax (93%), raised intracranial pressure (82%), and bullous emphysema (77%) were most frequently cited absolute contraindications. MI-E was most commonly administered via facemask (95%), tracheostomy (89%) and mouth piece (89%) with use via endotracheal tube less common (35%). Mean inspiratory pressure was 31 cmH2O; expiratory pressure -32 cmH2O. Complications included mucus plugging (29%), pain (25%), and hypotension (24%). Most commonly cited barriers were lack of expertise (73%), knowledge (67%), equipment (49%), and resources (49%).

Conclusions: We found moderate adoption of CAT, particularly for secretion management. Lack of expertise and knowledge are potentially modifiable barriers addressed with educational interventions.

Keywords: Cough augmentation, Mechanical insufflation-exsuff
EARLY PROGNOSTICATION IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME BY COMBINING DIFFERENT BIOMARKERS

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Background/Purpose: Early prognostication in patients with acute respiratory distress syndrome (ARDS) is challenging. Multiple pathways and molecules have been implicated in the pathogenesis of the associated lung damage and suggested as prognostic biomarkers. We hypothesized that, in a heterogeneous population of ARDS patients, disease severity would be proportional to the number of altered prognostic biomarkers.

Methods: We included consecutive admissions to our intensive care department with a diagnosis of ARDS using the Berlin definition. Plasma concentrations of biomarkers (interleukin-6, syndecan-1, angiopoietin-2, e-selectin, tissue metalloproteinase inhibitor-1, von Willebrand factor, soluble intercellular adhesion molecule-1, surfactant protein-D) were measured within 24 hours after diagnosis. For each biomarker, we calculated the best cut-off point for ICU mortality, giving scores of 1 and 0 for values above and below the cut-off, respectively. We then summed the individual values for each patient. We compared the ability of our score to predict mortality with that of the APACHE II score and the PaO$_2$/FiO$_2$ ratio by calculating the areas under the receiver operating characteristic curves (AUROC).

Results: Patient characteristics are shown in Table 1. Our score had an AUROC (95%CI) of 0.75 (0.63-0.88) vs 0.70 (0.58-0.83) for the APACHE II score and 0.53 (0.40-0.66) for the PaO$_2$/FiO$_2$. Patients with scores >4 had a 67% mortality, compared to 21% for patients with scores ≤4 (p<0.01). The risk of death was proportional to a score based on the number of abnormal biomarkers (Figure 1, p<0.01).

Conclusions: A simple biomarker-based score can improve early prediction of risk of death in ARDS patients.

Keywords: Sepsis, Prognosis, Risk stratification, Biomarker
COMPARISONS BETWEEN ACUTE RESPIRATORY DISTRESS SYNDROME CAUSED BY PULMONARY TUBERCULOSIS AND SEVERE PNEUMONIA USING PROPENSITY-MATCHED ANALYSIS

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Background/Purpose: Pulmonary tuberculosis (TB) is a chronic disease, but it could progress rapidly and result in acute respiratory distress syndrome (ARDS). However it is not easy to distinguish ARDS caused by TB from severe pneumonia that needed mechanical ventilation. This retrospective study was aimed to determine the baseline clinical diagnostic factors between ARDS caused by TB or severe pneumonia.

Methods: We retrospectively reviewed 45 patients with ARDS caused by TB and 90 patients with severe pneumonia who admitted intensive care unit and received mechanical ventilation at Chonnam National University Hospital and Gwangju Christian Hospital between January 2000 and February 2015. Propensity-matched analysis was performed according to age, sex, comorbidities and smoking history.

Results: Of total 135 patients, 41 patients from each group were matched by propensity scores. Median age was 71.0 (interquartile range [IQR] 60.8-77.0) and 63 (76.8%) were male. In the radiologic findings, miliary nodules and cavities were associated with ARDS due to TB and consolidation was related to severe pneumonia. The median acute physiologic assessment and chronic health evaluation (APACHE) III score and pneumonia severity index (PSI) were significantly lower in ARDS due to TB. Miliary nodules (Odd ratios [OR] 28.63, 95%CI 3.19-257.23; p=0.003), cavities (OR 8.58, 95%CI 1.51-48.57; p=0.015) and APACHE III score (OR 0.98, 95%CI 0.96-0.99) were independent factors to distinguish ARDS due to TB from severe pneumonia.

Conclusions: Lower APACHE III score and presence of miliary nodules and cavitary lesions in chest radiography are supporting diagnosis of ARDS with TB than severe pneumonia.

Keywords: Tuberculosis, Acute respiratory distress syndrome
ACUTE RESPIRATORY DISTRESS SYNDROME: INCIDENCE AND RISK FACTORS IN CRITICALLY ILL SURGICAL PATIENTS: A MULTI-CENTER THAI UNIVERSITY-BASED SURGICAL INTENSIVE CARE UNITS STUDY (THAI-SICU STUDY)

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Background/Purpose: Although the pathology and treatment of acute lung injury (ALI) / acute respiratory distress syndrome (ARDS) had been well established, the incidence and outcomes have not been consistently demonstrated. Variations in healthcare systems, demographics and types of ICUs are plausible explanation. This study aimed to evaluate the incidence, risk factors and outcomes of ALI/ARDS in SICUs.

Methods: The THAI-SICU study was a multi-center, prospective, observational cohort study including nine-university-based SICUs across the country between April 2011 and January 2012. All adult surgical patients with age ≥ 18, admitted to the general SICUs were recruited. The primary outcome was the incidence of ALI/ARDS. ALI/ARDS were defined by using AECC definition.

Results: Of the 6,548 enrolled patients, 1,896 patients were excluded leaving 4,652 patients remained in the analysis. ALI/ARDS was developed in 114 patients (2.5%) and the average PaO₂/FiO₂ ratio of ALI/ARDS patients was 224.67 ± 132.57. ALI/ARDS patients had higher APACHE II (20 vs. 11.4, p value < 0.001) and SOFA scores (7.3 vs. 3.1, p value < 0.001) and demonstrated higher number of smoking history or currently smoking. (48% vs. 36%, p value < 0.001). There were significantly higher number of pneumonia, shock, sepsis and acute kidney injury in ALI/ARDS patients. The 28-day mortality was significantly higher in ALI/ARDS patients (50% vs. 12 %, p-value < 0.001). Higher APACHE II and SOFA scores as well as the smoker or ex-smoking were independent predictors for ALI/ARDS.

Conclusions: The incidence of ALI/ARDS in THAI-SICUs study are low but high mortality rate. Higher severity scores and smoking were associated with ALI/ARDS.

Keywords: Acute lung injury, Acute respiratory distress syndrome

<table>
<thead>
<tr>
<th>Independent risks factors for ALI/ARDS</th>
<th>Odds Ratio</th>
<th>P-value</th>
<th>95% Confidence Interval</th>
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<tr>
<td>APACHE II</td>
<td>1.08</td>
<td>&lt;0.001</td>
<td>1.05 – 1.10</td>
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<tr>
<td>SOFA</td>
<td>1.12</td>
<td>&lt;0.001</td>
<td>1.08 – 1.17</td>
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<tr>
<td>Still Smoking or Ex-smoking</td>
<td>1.24</td>
<td>0.008</td>
<td>1.05 – 1.44</td>
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<tr>
<td>Incremental of ASA classification</td>
<td>1.35</td>
<td>0.07</td>
<td>0.97 – 1.88</td>
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EXTENT OF PLEURAL EFFUSION ASSESSED BY CHEST X RAY IS ASSOCIATED WITH FAILURE OF HIGH FLOW NASAL CANNULA OXYGEN THERAPY

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Background/Purpose: High flow nasal cannula (HFNC) is a novel oxygen therapy that is indicated to patients with acute respiratory failure. However, HFNC is occasionally failed in those patients. It is unclear whether certain pathologies, such as pleural effusion, are associated with HFNC failure. The objective of this study is to determine whether pleural effusion is associated with HFNC failure.

Methods: We reviewed 73 patients of acute respiratory failure treated with HFNC between January 2012 and December 2014. HFNC failure was defined as invasive or non-invasive positive pressure ventilation following HFNC. Chest X ray was evaluated with the numbers of quadrants in which consolidation or ground glass opacity presented and pleural effusion (PE) score.

Results: Of 73 patients, 29 patients failed HFNC therapy. PE score was significantly higher in the failure group, but the numbers of quadrants with opacity was not different between the groups. Additionally, age and sequential organ failure assessment (SOFA) score were significantly higher, and Glasgow Coma scale was significantly lower in the failure group. Multivariate analysis demonstrated that PE score (odds ratio [OR] 1.50; 95% confidence interval [CI] 1.11-2.03: p = 0.01) and SOFA score (OR 1.30; 95% CI 1.03-1.64: p = 0.03) were associated with HFNC failure, independently.

Conclusions: In addition to the severity of illness, the extent of pleural effusion assessed by chest X ray was associated with HFNC failure.

Keywords: High flow nasal cannula, Respiratory failure, Pleural effusion
LUNG OXYGENATION AND THE MORTALITY IN ARDS IN NAGOYA UNIVERSITY 2011-2014

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Background/Purpose: Acute respiratory distress syndrome (ARDS) definition (Berlin criteria) provides new three classifications in ARDS. We clarify the relationship between lung oxygenation and mortality according to the Berlin criteria in our emergency and medical ICU.

Methods: Retrospective analysis was conducted on ARDS hospitalized in the ICU of Nagoya University hospital in Japan, for 48 hours or more, from May 2011 to March 2014. ARDS were extracted from our medical chart and classified into mild ARDS, moderate ARDS and severe ARDS, based on the Berlin criteria. We analyzed the APACHE II score at the time of hospitalization, underlying disease, and the 28-days mortality of each group.

Results: 175 cases were extracted as ARDS in total 1270 ICU admission. The number of patients with mild, moderate and severe ARDS were 42 (24%), 78 (44.6%) and 55 (31.4%), respectively. The mean of the APACHE II score of each group was 28.0, 30.6 and 30.8. The 28-days mortality of each group was 3 (7.1%), 5 (6.4%), and 14 (25.5%), respectively. 28-days mortality was significantly high in severe ARDS. The cause of death is such as senility and brain injury in mild and moderate ARDS, meanwhile the main cause of death of 70% in severe ARDS was organized interstitial pneumonia.

Conclusions: This study revealed an importance in the treatment of severe ARDS. We need proper management to preventing exacerbation of pulmonary fibrosis in ARDS.

Keywords: ARDS, Lung oxygenation, Mortality, Pulmonary fibrosis
LONG-TERM MORTALITY OF COPD PATIENTS FOLLOWING INTENSIVE CARE UNIT DISCHARGE

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Background/Purpose: COPD remains a globally significant cause of mortality, although COPD mortality varies from country to country, and across different regions within each country. The aim of this study was to analyze mortality rates in patients with COPD who are admitted to the medical intensive care unit (ICU) and to identify variables associated with mortality.

Methods: Medical records of COPD patients consecutively admitted to the ICU over a 10 year period were reviewed.

Results: The study included 147 patients (76% male, mean age 73±9 years, mean APACHE II score 20±7, 75% had co-morbidities). 72 patients were treated initially with non-invasive mechanical ventilation (NIMV), and 12 patients required intubation after NIV had failed. Therefore, 86 patients were intubated and received mechanical ventilation (IMV), while NIV was successful in 60 patients. One patient received medical treatment only. ICU and hospital mortality rates were 27% versus 31%, respectively. The mortality rates at 1, 2, and 5 years were 54%, 66% and 84%, respectively. In cox-regression analysis, survival was independently associated with age >73 years (HR 1.03 (1.00-1.05)), APACHE II score >20 (HR 1.06 (1.02-1.09)), presence of co-morbidities (HR 1.93 (1.19-3.14)) and need for IMV (HR 1.84 (1.24-2.74))

Conclusions: This study reports increased mortality rates following ICU discharge in COPD patients. Risk factors related with mortality were advanced age, high APACHE II score, presence of co-morbidities and IMV requirement.

Keywords: COPD, Acute respiratory failure, Mortality, ICU
IS THE MILD SEVERITY CLASSIFICATION OF ARDS UNDERRATED? - PRELIMINARY RESULTS FROM A NATIONWIDE GERMAN COHORT

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Background/Purpose: Acute respiratory distress syndrome (ARDS) is a potentially life-threatening disease, caused either by direct or indirect pulmonary injury resulting in mechanical ventilation. Management of ARDS is associated with cost and staff burden and has substantial socio-economic impact.

Methods: In this multi-centre, prospective ARDS cohort study actually 179 patients (Berlin Definition) are included from 46 German hospitals. Individual patient characteristics were recorded.

Results: Baseline patient’s characteristics: 62% male, age 59.6 ± 17 years, BMI 28.7 ± 7 kg/m², waist-to-height-ratio 0.60 ± 0.1, 80% direct pulmonary damage. Severity: 13% mild, 48% moderate and 39% severe. Male gender was found to be associated with greater ARDS severity (p=0.064). Level of school education (low /moderate/high = 53/32/15 %) was not significantly different between severity groups (p=0.311). Transferral to specialized centres was significantly more frequent in moderate to severe ARDS (p=0.001) (41% ECMO during transportation). In patients with severe ARDS initial infections were more frequent in comparison with mild disease (71 vs 52%, p=0.238). The mean duration of ICU stay was 24 d, 24% requiring ECMO (mean 15 d with an ICU-survival rate of 52%). The overall ICU mortality was 34%. Mortality did not differ significantly between severity groups (mild: 30.4 %, moderate: 34.9 %, severe: 34.3 %, p=0.922).

Conclusions: First results from a German ARDS study reveal important aspects: The low fraction of mild ARDS and the lack of association between ARDS severity and ICU-mortality might be an indicator for underestimation in clinical practice. In tendency male gender and obesity were associated with increased ARDS-severity.

Keywords: Acute respiratory distress syndrome, Gender, Socio-economic status, ICU mortality
WHY DO WE HAVE TO ALERT AND TREAT SUBCUTANEOUS EMPHYSEMA EARLY?

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Background/Purpose: Subcutaneous emphysema sometimes needs close observation. Not rarely, it may develop serious clinical settings, such as dyspnea, hemodynamic instability, and finally result in fatal respiratory failure. We retrospectively analyzed 117 cases with subcutaneous emphysema to determine the clinical significance of subcutaneous emphysema.

Methods: We reviewed the chest radiography from January 2010 to January 2015 and medical records of 117 patients who showed overt subcutaneous emphysema in our center. There were 81 males and 36 females, and their mean age was 52.6±11.3. The important causes of subcutaneous emphysema were laparoscopic surgery, thoracic surgery, and pneumothorax in frequency. Significant emphysema was successfully treated with bilateral blow-holes with or without closed thoracostomy.

Results: Of 117 cases, 13 patients (mean age: 53.4±9.1 years old) needed surgical interventions, such as bilateral blow-holes incision below the clavicles, closed thoracostomy, or combinations. The clinical deteriorations happened mainly in operating room (n=3), emergency room (n=5), intensive care unit (n=4), and elsewhere (n=1). The important clinical manifestations including crepitation were dyspnea (n=8), tachycardia, and catastrophic ventilator failure (n=5) in the worst cases. There were two deaths: one before arrival, and the other died of pneumonia one month after recovery from fatal tension subcutaneous emphysema. There were significant risk factors for predicting subcutaneous emphysema resulting in respiratory failure by univariate analysis (p= 0.04 on ventilator care, p=0.05 in thoracic surgery), but no risk factors by multivariate analysis.

Conclusions: This simple and important procedure for tension subcutaneous emphysema should be remembered by the personnel working in intensive care unit or emergency room.

Keywords: Subcutaneous emphysema, Ventilatory failure, Blow-hole incision
INCREASED END-EXPIRATORY LUNG VOLUME WITH HIGH FLOW NASAL CANNULA: COMPARISON 3 NASAL CANNULA DEVICE

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Background/Purpose: High flow Nasal Cannula (HFNC) delivers high flow warmed and humidified air and oxygen via nasal cannula. Recently, a new nasal cannula device was designed and can produce the jet flows directed towards the nasal prongs. Electrical impedance tomography (EIT) estimates changes in lung volume by measuring changes of lung impedance. The purpose of our study was to compared the new device(OmniOx-HFT500,MEKICS,Seoul,Korea) and other 2 conventional(Optiflow, Fisher & Paykel Healthcare, Auckland, New Zealand and Vapotherm, Stevensville, Maryland, USA) nasal cannula device on end expiratory lung volume and nasal pressure.

Methods: Prospective study with 29 healthy volunteers was performed from September 01, 2013 to December 31, 2013. After 2 minutes breathing ambient air, HFNC was applied for 12 minutes. The air flow was increased from 30L/min to 40L/min every 3 minutes. For each device, global and regional end-expiratory lung impedance variations (EELI) were measured by EIT. Pharyngeal pressure, air flow rate, and EELI were recorded as flow increased.

Results: The BMI of healthy volunteers was 23.8±3.3 kg/m2 and male were 14. There was not different in pharyngeal pressure (p=0.137, and p=0.15) and global ΔEELI (p=0.152, and p=0.232) at 30L/min and 35L/min. At 40L/min, there was a significant difference in pharyngeal pressure (OmniOx: 4.8±0.7 vs. Optiflow: 3.4±0.5 vs. Vapotherm: 3.0±0.7, p=0.04) Global ΔEELI was similar (OmniOx: 1.4±1.4 vs. Optiflow: 1.4±1.0 vs.Vapotherm: 2.0±2.4, p=0.467).

Conclusions: New nasal device and conventional nasal devices similarly increased the end expiratory lung volume and created positive oropharyngeal airway pressure.

Keywords: High flow nasal cannula, Electrical impedance tomography
RISK FACTORS OF SERUM CARNITINE DEFICIENCY AND INFLUENCE ON THE HOSPITAL STAY IN CRITICALLY ILL PATIENTS

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\textbf{Background/Purpose:} To explore the risk factors of serum carnitine deficiency and influence on hospital stay in critically ill patients.

\textbf{Methods:} Critically ill patients with APACHE II>12 were enrolled to this prospective observational study from Mar to Sep 2013. Serum carnitine, disease severity and organ function were observed. The relationship between serum carnitine deficiency and organ function, disease severity were analyzed. The influence of serum carnitine deficiency on the tolerance of enteral nutrition, length of ICU and hospital stay and mortality were analyzed.

\textbf{Results:} Serum carnitine significantly decreased in all 30 patients at 8.92±5.05 μmol/L. Significant negative correlation were observed between serum carnitine, APACHE II and serum total bilirubin. During 5-day-observation, enteral feeding was 5134±1173 ml and positively correlated with serum carnitine. The incidence of abdominal distension and diarrhea were 40% and 26.7%. Average hospital stay was 34.72 ± 16.66 days and serum carnitine was significantly lower in patients with hospital stay ≥ 45 days comparing with those 45 < days. Average ICU stay was 18.60±10.72 days and no correlation between serum carnitine level and ICU stay. In-hospital mortality was 26.7% and no significant difference between the mortalities and survivals in serum carnitine. No correlation between serum carnitine and in-hospital mortality.

\textbf{Conclusions:} Serum carnitine deficiency is severe in critically ill patients and correlated with disease severity and liver function. Lower serum carnitine level reduces total enteral feeding. Serum carnitine deficiency could prolong the hospital stay of critically ill patients.

\textbf{Keywords:} Serum carnitine, Critically ill patient
USEFULNESS OF N-TERMINAL PRO-B-TYPE NATRIURETIC PEPTIDE AS A PREDICTIVE MARKER OF MORTALITY IN CRITICALLY ILL SURGICAL PATIENTS

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Background/Purpose: This study is aimed to determine the association between serum N-terminal pro-B-type natriuretic peptide (NT-proBNP) and mortality in critically ill surgical patients.

Methods: Retrospective medical review was conducted on 147 patients who managed in intensive care unit after emergency abdominal surgery from January 2012 to December 2014. Potential predictive biomarkers of mortality including NT-proBNP was compared between the survivor group (S, n = 123) and the non-survivor group (NS, n = 24). The cut-off values were determined by ROC curve. Independent predictors were identified by a multivariate logistic regression analysis.

Results: In the univariate analysis, the median NT-proBNP, lactate, base excess and vasopressor use were shown significant difference between group S and NS (NT-proBNP 909.3 pg/mL vs. 4765.0 pg/mL; p = 0.001, lactate 1.8 mmol/L vs. 3.2 mmol/L; p = 0.001 and base excess -5.1 mmol/L vs. -8.5 mmol/L; p = 0.003). In NS group, vasopressor were used more frequent than S group (p = 0.002). The cut-off values were 1636 pg/mL of NT-proBNP, 1.8 mmol/L of lactate and -7.9 of base excess, respectively. In the multivariate analysis, NT-proBNP (odds ratio [OR] 4.057; 95% confidence interval [CI] 1.409 - 11.683; p = 0.009), lactate (OR 4.766; 95% CI 1.272 - 17.862; p = 0.021) and vasopressor use (OR 3.391; 95% CI 1.234 - 9.321; p = 0.018) were significantly associated with mortality.

Conclusions: NT-proBNP may be significant predictor of the mortality in critically ill surgical patients.

Keywords: NT-proBNP, Lactate, Predictors
UNDERSTANDING INTENSIVE CARE UNIT PATIENT FLOW THROUGH DISCRETE EVENT SIMULATION

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Background/Purpose: Any interruption in patient flow leads to admission and discharge delays and affects patient care. This reduced bed availability negatively impacts patient safety, satisfaction and hospital costs. In anticipation of a hospital expansion without additional intensive care unit (ICU) beds, we developed a computer simulation model with the purpose of predicting future ICU utilization and patient throughput.

Methods: Using industrial engineering methodology and FlexSim Healthcare Software, we developed a patient flow simulation model to analyze ICU patient flow through discrete event simulations (DES). Finally, we tested the model and monitored its performance through active continuous improvement module methodology.

Results: Our model had a 3.53% margin of error (MOE) in ICU admission rates with 2,649 simulated versus 2,746 actual patient admissions. Through process flow mapping and model development, we identified admission delays of 93 minutes. The ICU model also predicted an ICU utilization of 59% in contrast to an actual 62% utilization for a 4.83% MOE. The MOE for discharge delays was 4.81% (5.23 simulated hours versus 4.99 actual hours).

Conclusions: The creation of the simulation model provided us a more detailed understanding of our ICU patient flow and identified areas for process improvement. DES is a helpful administrative tool to understand ICU patient flow, safely test real life bed capacity scenarios, and simulate optional solutions to determine the best possible outcome decision based on experimental testing. We are currently using this tool to improve our staffing, resource management, and reduce costs.

Keywords: Discrete event simulation, Patient flow, Costs, Resource utilization, Patient safety
DEVELOPMENT OF PATIENTS INFORMATION PROTECTION AWARENESS SCALE

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Background/Purpose: Despite of importance on patients information protection in clinical settings, little is known about its awareness in nursing students due to lack of measurement tool. Thus, the purpose of this study was to develop the Patients Information Protection Awareness Scale, and evaluate its construct validity and reliability for nursing students.

Methods: A cross-sectional descriptive study was conducted to develop and evaluate the validity and reliability. Nursing students who are at 3rd and 4th grade were recruited form 10 Universities in South Korea for construct validity, and 30 experts such as 27 nurses and 3 faculties participated in content validation process. All study procedures approved by The Chungnam National University College of Nursing Institutional Review Board.

Results: Content validity of the PIPA scale was reached as 23 items. Construct validity using exploratory factor analysis revealed 3 factors such as communication, management and referrals. The 3 factor accounted for 54.1% of the variance in the PIPA scale. The model indices of PIPA scale with 3 factors had a good fit in confirmatory factor analysis. The PIPA scale confirmed the good reliability with a value of Cronbachs alpha on 0.94 of the total items.

Conclusions: The PIPA scale with 23 items was reliable and valid tool. Using the PIPA scale, we can easily assess the awareness of patient information protection in nursing students. Based on the level of its awareness, nursing academic and health organization can administer the adequate education plan for safeguard information in nursing students.

Keywords: Measurement, Information, Validity, Reliability
POST OPERATIVE GASTROINTESTINAL FUNCTION, HEPATIC FUNCTION, TISSUE INJURY IN RUPTURED AAA CASES

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Background/Purpose: Organ dysfunction occurs in patients with ruptured abdominal aneurysm (rAAA). The present study evaluated the impact of Endovascular aneurysm repair (EVAR) on postoperative gastrointestinal function, hepatic function and tissue injury.

Methods: We retrospectively reviewed all the patients with rAAA who underwent open repair (OR) or EVAR at our institution from January 2013 to July 2014. EVAR was the first line of treatment and then, in cases the EVAR was not feasible, OR was performed. The gastrointestinal function was monitored by the day of oral intake. The hepatic function was monitored by serum transaminase, G-GPT, bilirubin level. Tissue injury was monitored by serum CK level. Blood test was performed preoperatively and postoperatively for 7 days.

Results: Consecutive 22 patients (79.0±9.1 y.o. male 18) were included. Ten had OR (80.3±6.5 y.o. male 10) and twelve had EVAR (77.9±10 y.o. male 8). Mortality (OR: EVAR= 50: 25 %) and the number of patients with shock on arrival (OR: EVAR= 5:6) had no significant difference between the two groups. The day of the restart of oral feeding had no significant difference. Serum AST level was higher in OR with significance in post-operative day (POD) 2, 3, and 4. The bilirubin level was almost the same. Serum CK level was higher in OR from POD 0 through POD 6.

Conclusions: Although there was not significant difference in postoperative gastrointestinal function and hepatic function, post operative course of tissue injury was better with significance in EVAR group than OR group.

Keywords: EVAR, Ruptured AAA, Gastrointestinal function, Hepatic function

| Table 1 |
Table 2
IS IT POSSIBLE TO DISTINGUISH SEPTIC SHOCK FROM OTHER CAUSES OF SHOCK BY ANALYZING VARIATION OF ARTERIAL PRESSURE WAVEFORM? : A SINGLE-CENTER PILOT STUDY

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Background/Purpose: Septic shock is characterized by hemodynamically unstable condition such as hypovolemic, cardiogenic, and distributive shock. It requires early recognition and treatment. Arterial pressure waveform is the changes in peripheral vessel pressure associated with beating of the heart. Its analysis can allow to determine the vascular status, which may be varied in critically ill conditions. The objective of this study was to investigate whether the changes in vascular properties could provide early and corrective resuscitation in septic shock by analyzing arterial pressure waveform.

Methods: Seven septic shock and five hypovolemic shock patients admitted to the emergency intensive care unit at our tertiary hospital were included in this study. Cardiac output and pulse waveform was recorded by arterial line placed in radial artery with the Lidco Rapid or Vigileo monitor. The pulse waveform of diastolic phase was analyzed in accordance with Windkessel (WK) model which provided the time variation of the mechanical properties of the blood vessels.

Results: Most of the patients showed that a decrease in blood pressure leads to an increase of parameter C1 and L, and drop of R described in WK model. However, parameter C2 dropped in septic shock, by contrast, it remained unchanged in hypovolemic shock. The changes in blood pressure were preceded by changes in vascular properties in some patients, which could lead to early recognition and prediction for hemodynamic changes.

Conclusions: The analysis of changes in vascular properties may be helpful to optimize hemodynamics of septic shock including aggressive fluid resuscitation or vasoactive agents.

Keywords: Septic shock, Hypovolemic shock, Arterial pressure waveform

![Four-element Windkessel model](image)

Fig. Four-element windkessel model
C1, C2, L and R represents proximal vessel compliance, peripheral vessel compliance, ineritance and systemic vascular resistance, respectively.
PREDICTION OF ADVERSE OUTCOMES AFTER COMBINED AVR AND CABG USING CONTEMPORARY RISK MODELS

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Background/Purpose: Aortic valve replacement (AVR) and/or coronary artery bypass grafting (CABG) make up the majority of cardiac surgeries with increasing demand as the population ages. Accuracy of risk stratification is important, especially as interventional aortic valve and coronary procedures continue to blossom, but have been rarely studied for the combined AVR+CABG operation. We compared the prognostic utility of EuroSCORE, EuroSCORE II and Society of Thoracic Surgeons (STS) Score for AVR+CABG.

Methods: All patients undergoing AVR+CABG at Auckland City Hospital during 2005-2012 were included, with the three risk scores calculated and their discrimination and calibration for mortality and morbidities assessed.

Results: 450 patients with AVR+CABG were included, with mean follow-up of 4.7 years. Operative mortality was 6.4% (29), and mean scores were EuroSCORE 12.511.1%, EuroSCORE II 6.66.1% and STS Score 5.54.4%. C-statistics were 0.587, 0.669 and 0.699 respectively for operative mortality, Hosmer-Lemeshow test P-values were 0.064, 0.718 and 0.567, and Brier Score 0.716, 0.585 and 0.588. Independent predictors of operative mortality were history of myocardial infarction and impaired renal function. STS score also was the best score at detecting late mortality (c=0.643), composite morbidity (c=0.627), stroke (c=0.642), prolonged ventilation>24 hours (c=0.642), and return to theatre (c=0.612).

Conclusions: The STS score has the best discrimination (albeit moderate) for mortality and most complications after AVR+CABG, while its calibration was similar to EuroSCORE II and better than EuroSCORE. It should therefore be used in risk stratification and also consideration of surgical or percutaneous approach in those with concurrent aortic valve and coronary artery disease.

Keywords: Cardiac surgery, Risk prediction model, AVR, CABG
USING OF RIVAROXABAN IN PATIENTS WITH DEEP VENOUS THROMBOSIS

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Background/Purpose: A prospective study was conducted to compare the effect of enoxaparin and rivaroxaban with using the low-frequency piezoelectric thromboelastography (LPTEG)

Methods: 60 patients with DVT of lower extremities were divided into 2 groups: the 1st group (n=30) were receiving enoxaparin in dosage 1.5 mg/kg subcutaneously per day, the 2nd group(n=30) were receiving rivaroxaban orally 15 mg per day. For checking the coagulation state we were using indicators of LPTEG as constant thrombin activity (CTA), intensity of coagulation drive (ICD) and gel point (GP).

Results: LPTEG indicators that determine coagulation state after 4 hours in 1st group: CTA was decreased on 72.12 %, ICD was decreased on 68.44, GP was increased on 17.9%, in 2nd group: CTA was decreased on 76.24%, ICD was decreased on 74.52 %, GP was increased on 23.34 %. After 12 hours CTA in 1st group decreased on 22.41%, ICD decreased on 5.3%, GP increased on 8.12% that indicating reducing of hypocoagulation effect, in the 2nd group CTA decreased on 39.35%, ICD decreased on 40.24%, GP increased on 18.25%. After 24 hours in the 1st group group LPTEG indicators returned to the original value, in the 2nd group of patients CTA was decreased on 15.14%, ICD was decreased on 6.62%, GP increased on 14.22%.

Conclusions: Hypocoagulation effect of rivaroxaban continuous 24 hours after oral administration compared to enoxaparin, which retains less hypocoagulation effect after 12 hours after administration. LPTEG indicators in 2nd group was bigger than in 1st group after 12 hours: CTA on 43.07%, ICD on 69.72%, GP on 54.12 %.

Keywords: DVT, Thromboelastography, Coagulation
CAN WE USE THE LOW-FREQUENCY PIEZOELECTRIC TROMBOELASTOGRAPHY FOR DIAGNOSIS COAGULATION DISORDERS?

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Background/Purpose: It is known that deep vein thrombosis of lower extremities and pulmonary embolism occupies an important place in the structure of postoperative morbidity and mortality.

Methods: We studied the functional state of hemostasis in a group of 60 healthy volunteers, who were not receiving drugs affecting coagulation. Monitoring of hemostasis was by low-frequency piezoelectric thromboelastogram (LPTEG), platelet aggregation test (PAT), standard coagulation tests (SCT) and thromboelastogram (TEG).

Results: It was found that the indexes of LPTEG as the intensity of the contact phase of coagulation (ICC), the time the contact phase of coagulation (t1), and initial rate of aggregation of blood (A0) were correlated with PAT indexes as the spontaneous platelet aggregation and epinephrine-induced platelet aggregation (0.59 0.76); the intensity of coagulation drive (ICD) correlate with activated partial thromboplastin time of SCT (0.56) and reaction time to initial fibrin formation of TEG (0.64), maximum density of the clot (MDC) with fibrinogen level of SCT (0.67) and maximal amplitude of TEG (0.86) a constant thrombin activity (CTA) with thrombin time of SCT (0.78) and clotting time of TEG (0.93), and the intensity of the retraction and clot lysis (IRCL) with the total fibrinolytic activity of SCT (0.83) and clot lysis of TEG (0.74).

Conclusions: LPTEG allows make the total assessment of all parts hemostasis: from initial viscosity and platelet aggregation to coagulation and lysis of clot. We can use the indexes ICC, A0, t1 for control aggregation, ICD, MDC, CTA for control coagulation and IRCL for control fibrinolysis.

Keywords: Hemostasis, Coagulation, Thromboelastogram
MANAGEMENT OF VASCULAR ACCESS IN HEMODIALYSIS PATIENTS

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Background/Purpose: We have started hemodialysis medical therapy from April, 2011 in Okayama Saidaiji Hospital. Management of vascular access (VA) has been mainly performed by the combination of ultrasoundography (US) and change in clearance gap (CL-Gap). Here we report the outcome of our programmed VA management in the slogan which provides appropriate treatment before VA occludes.

Methods: Making of US-based VA maps was done by using Viamo (linear probe 7.5MHz, Toshiba Co.) in all patients every two months. Calculation of CL-Gap was performed once a month and abnormal values of CL-Gap were followed up carefully. Education of patients about the importance of VA was performed with their families every three months.

Results: We encountered a total of 170 cases of VA-associated problems; stenosis and occlusion. As for 145 of 170 cases, balloon-based Percutaneous Transluminal Angioplasty (PTA) was successfully carried out premeditatedly. Sudden occlusion of VA was occurred without significant CL-Gap change in 25 cases. Four of 25 emergencies were treated with a balloon-mediated PTA, and 12 cases required percutaneous thrombectomy followed by balloon dilation, and 8 cases required reconstruction of VA. Placement of a double-lumen catheter was applied for one case.

Conclusions: In spite of stringent US examination and CL-Gap administration, approximately 15% of VA complications were occurred unexpectedly. Because the aging of the dialysis patient advances, further careful observation at VA will be considered.

Keywords: Vascular access, Ultrasonography, Angioplasty
**PMI IN PATIENT UNDERGOING MAJOR NONCARDIAC SURGERY ADMITTING TO GENERAL SURGICAL ICU: EFFECT OF PREOPERATIVE CARDIAC PROTECTIVE INTERVENTIONS ON PERIOPERATIVE HEMODYNAMIC & OUTCOME**

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**Background/Purpose**: PMI is a major cause of cardiac morbidity/mortality in pts undergoing major noncardiac surgery. The aim of this study was to study incidence, risk factors of PMI & effect of β-adrenergic blocking agent on periop hemodynamic derangement&outcome.

**Methods**: This prospective observational study was done in 430 pts with moderate-high clinical risk for PMI underwent major noncardiac surgery admitting to general surgical ICU at Siriraj Hospital. PMI surveillance [cTnT, EKG & clinical associated with PMI] was done q 8 hrs on day 1-3postop. Outcome as hemodynamic derangement, incidence of intraop & immediate postop PMI & mortality were analyzed.

**Results**: The incidence of PMI was 23%, 86.5% was NSTEMI. Among the PMI patients: 9.4 % had serious arrhythmias, 12.5% had CHF, 11.5% had cardiogenic shock, 1% had rupture VSD needed emergency surgery, 4.2% had cardiac arrest with overall ICU mortality 11.6%. Multivariate analysis found β-adrenergic blocking agent (OR 1.885, 95%CI 1.230-2.887), significant CAD (OR 7.994, 95% CI 2.790-22.908), preop Cr>1.8mg/dL (OR 2.631,95%CI,1.449-4.619), FC<4 MET (OR 1.432, 95% CI 0.680-3.107), intraop hypotension(<20% of control)(OR 3.006,95%CI,1.449-6.288), hypertension(>20%of control)(OR 3.657,95%CI,1.674-7.990), hypovolemia(OR 3.143, 95%CI,1.392-7.097), sepsis(OR 2.335,95%CI,0.802-6.793), arrival ICU HR>100 beat/mins(OR 1.028,95%CI,1.010-1.048) were significant risk factors of PMI. Preop coronary revascularization (OR 0.237,95%CI,0.070-0.807) was a significant protective factors of PMI. Preop long acting β-adrenergic blocking agent associated with more bradycardia (p<0.013) while β-adrenergic blocking agent associated with more tachycardia (p<001).

**Conclusions**: PMI was a significant periop morbidity/mortality in patient undergoing major noncardiac surgery. More care should be done in pts taking β-adrenergic blocking agent.

**Keywords**: PMI, Beta block, Non cardiac surgery
CLINICAL OUTCOMES OF UTILIZING PHARMACOMECHANICAL THROMBECTOMY IN ACUTE DEEP VEIN THROMBOSIS PATIENTS

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Background/Purpose: The gold standard for deep vein thrombosis (DVT) treatments is still anticoagulants, but these medications are not able to resolve preexisting clots. Pharmacomechanical thrombectomy (PMT) is a method that directly infuses thrombolytic agents into the thrombus. This would allow expedient thrombus lysis and less post thrombotic syndrome while avoiding major bleeding risks. However, clinical outcomes, such as DVT recurrence rates, have not been well established. The objectives of this study are to identify the clinical outcomes of utilizing PMT for DVT treatment and to promote awareness regarding the safety and efficacy of PMTs.

Methods: This is a retrospective chart review of patients receiving PMT from January 1, 2008 to September 1, 2014 at the Hendrick Medical Center. Primary outcome is the readmission rate due to DVT within 6 months. Secondary outcomes are length of hospital and ICU stay, hospital mortality, bleeding rate, and other morbidities associated with PMTs. Also, risk factors associated with primary and secondary outcomes will be identified. Descriptive statistics will be used to describe patient characteristics, primary and secondary outcomes.

Results: Forty-nine patients were included, 27 were female and 22 were male. The mean age was 55 (+/- 17.7) years. Twelve subjects received the Trelis procedure and 37 received the AngioJet procedure. Three patients were readmitted for recurrent DVT (6.6%). There were five bleeding events related to the procedures (10.2%). The average length of hospital stay was 10 (+/- 7) days.

Conclusions: PMT appears to be a safe and reliable treatment option for DVT.

Keywords: Deep vein thrombosis, Pharmacomechanical thrombectomy
THE CLINICAL CURATIVE EFFECT OF INTRAVENOUS THROMBOLYSIS IN MYOCARDIAL INFARCTION RESCU

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Background/Purpose: Research and analysis of the clinical curative effect of intravenous thrombolysis in myocardial infarction rescue

Methods: We retrospectively analyzed the clinical data of 92 patients with acute myocardial infarction admitted to Cardiology department from December 2012 to October 2014. According to the different treatment options, patients were randomly divided into intravenous thrombolysis group (observation group, 46 cases) and percutaneous coronary intervention group (control group, 46 cases). In the control group of 46 patients received percutaneous coronary intervention (PCI) treatment. Observation group of 46 patients received intravenous thrombolytic therapy. We observed the rates of recanalization and the occurrence of cardiovascular events of the two groups. We analysed the differences of cardiac function between the two groups by electrocardiogram and echocardiogram.

Results: The rates of recanalization in observation group was 76.1% (35/46), significantly lower than in the control group [93.5% (43/46)]. There was no statistically significant differences between the two groups in mortality [6.5% (3/46) vs. 4.3% (2/46)] (P<0.05). The electrocardiogram and echocardiogram during hospitalization showed tha the magnitude of ST segment resolution and the ejection fraction of left ventricular in control group was significantly higher than in the observation group (P<0.05). The end-systolic volume index and end-diastolic volume index of left ventricle was significantly lower than in the observation group (P<0.05). The difference was statistically significant.

Conclusions: Heart function of the patients who was treated by intravenous thrombolysis was worse than that of PCI. But the intravenous thrombolysis still is the primary means of rescue for patient with contraindication.

Keywords: Myocardial infarction, Intravenous thrombolysis
THE ASSOCIATION OF BODY MASS INDEX AND THE OUTCOME OF ACUTE CORONARY SYNDROME WITH HEART FAILURE PATIENTS IN INTENSIVE CARDIO VASCULAR CARE UNIT IN NATIONAL CENTER OF CARDIO VASCULAR HARAPAN KITA

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Background/Purpose: Obesity is one of the famous risk factor in the cardiovascular disease. There are researchs about paradoxical BMI, where the increase of BMI has protective effect on heart failure (HF) patients. However, there is lack of data about the BMI as an outcome predictor in the HF patients with acute coronary syndrome (ACS). This research aims to see the correlation between BMI and the patients’ outcomes in the ICVCU. The patients’ outcome was duration of stay in CVC, the hospital length of stay and in hospital mortality.

Methods: This research was conducted on September 2014- March 2015 in ICVCU of National Cardiovascular Center Harapan Kita, Jakarta, Indonesia using Cross Sectional Design. The subject of the research was 239 patients diagnosed with Heart Failure (HF) and Acute Coronary Syndrome (ACS), and collected with consecutive sampling. The BMI was grouped into 4 groups, underweight (<18.5), normal (18.5-24.9), overweight (25-29.9) and obese (>30).

Results: The results showed that the most frequent BMI was normal BMI (57.56%) and there were only 9.66% patients with obese. There is no association between the increase of BMI and the duration of stay in ICVCU (p=0.346), and the hospital length of stay (p=0.652). The mortality on ICVCU (p=0.232) and hospital discharge was also not associated with BMI (p=0.063).

Conclusions: The conclusion was that BMI was not associated with the patients’ outcomes, which was measured by length of stay in ICVCU, hospital length of stay, ICVCU discharge mortality and hospital discharge mortality.

Keywords: BMI, Acute coronary syndrome, Heart failure, Length of stay, Mortality
EXTRACORPOREAL MEMBRANE OXYGENATION SUPPORT IN ACUTE MYOCARDIAL INFARCTION WITH CARDIOGENIC SHOCK

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Background/Purpose: We analyzed the results of acute myocardial infarction (AMI) complicated with cardiogenic shock necessitating extracorporeal membrane oxygenation (ECMO). And we analyzed survival and ECMO weaning rate according to whether or not performing cardiopulmonary resuscitation (CPR) before ECMO support.

Methods: We retrospectively reviewed the medical records of 63 patients who underwent ECMO for AMI with cardiogenic shock from March 2008 to January 2015. There were 43 patients (68.3%) who underwent CPR before ECMO support.

Results: Total 63 patients, there were 50 male (79.4%) and 13 female (20.6%) and the mean age of patients were 58.60 ± 13.21 (range 29-86) year-old. Overall ECMO weaning rate was 58.7% (37/63), and overall survival rate was 31.7% (20/63). The ECMO weaning rate for no-CPR group was 100% (20/20) and discharge rate was 50% (10/20). The ECMO weaning rate for CPR group was 39.5% (17/43) and discharge rate was 23.3% (10/43). In CPR group, there was a statistical significance at total CPR time (from CPR start to stop because of ECMO start) and discharge rate. Mean CPR time of non-survival group was 48.39 ± 26.92 (range: 11-145) minutes and survival group was 30.10 ± 16.29 (range: 7-62) minutes. And there was statistical significance at survival rate between CPR group and no-CPR group.

Conclusions: ECMO support for AMI patients with cardiogenic shock offers more chance to survival. The period between the initiation of CPR and ECMO start was significant risk factor for survival rate.

Keywords: ECMO, Acute myocardial infarction, Cardiogenic shock
ASSOCIATION BETWEEN ECHOCARDIOGRAPHY HEMODYNAMIC PARAMETER CHANGES AND ST-SEGMENT RESOLUTION AFTER PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN ACUTE MYOCARDIAL INFARCTION

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Background/Purpose: The aim of a primary Percutaneous Coronary Intervention (PCI) is to improve the outcome and life expectancy in Acute Myocardial Infarctiion (AMI) patients. Recently, ST-segment resolution (STR) is used to recognize prognosis in AMI patients reflecting microvascular perfusion. However, echocardiography hemodynamic parameters such as Ejection Fraction (EF) and Tricuspid Annular Plane Systolic Excursion (TAPSE) were used to recognize the prognosis in clinical practice. The association between STR and echocardiography hemodynamic parameter changes can be useful evidence in so that STR can be used in recognizing the outcome. Unfortunately, the data of this association is still limited. The objective of this research is knowing the association between the STR and echocardiography hemodynamic parameter changes.

Methods: This study design was cross-sectional, conducted in National Cardiovascular Centre Harapan Kita, Jakarta, Indonesia using consecutive sampling. All patients who underwent Primary PCI were enrolled. The ST-segment elevation resolution before and first-24-hour after Primary PCI were calculated and grouped as good resolution (>50%) and poor resolution (>50%). The EF changes and TAPSE changes were measured immediately after PCI and hospital pre-discharged.

Results: There are 48 patients. 65% patients classified as good STR (n=33). The means of patients’ EF changes and TAPSE changes are -0.69±10 %, 0.01±0.3. Analytical study shows that there is no significant association between STR and EF changes (95% CI -1.8 to 10.3, p=0.167) and TAPSE changes (95% CI -0.2 to 0.1, p=0.587).

Conclusions: This study shows us that in clinical practice we cannot use STR as the only outcome predictor.

Keywords: ST segment resolution, TAPSE, Ejection fraction, Primary PCI
CONTINUOUS CEREBRAL MONITORING WITH AMPLITUDE-INTEGRATED ELECTROENCEPHALOGRAPHY DURING ECMO SUPPORT

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Background/Purpose: It is well known that the amplitude-integrated electroencephalography (aEEG) provides the useful information for neonatal encephalopathy. The aim of this study is to determine the efficacy of aEEG for identifying the brain injury during extracorporeal membrane oxygenation (ECMO).

Methods: We retrospectively reviewed data of 25 subjects who had bedside aEEG monitoring and who were survived to discharge after ECMO support from January 2012 to December 2013. We collected the data including patient demographics, clinical details of ECMO courses, and data of aEEG monitoring.

Results: A median age was 56 years (range, 2 days to 79 years), and a median length of ECMO therapy was 84 hours (range, 6 to 529 hours). Eleven patients (44%) received the extracorporeal cardiopulmonary resuscitation. The following findings of four voltage classifications were found in initial aEEG findings: continuous normal pattern (15 patients), discontinuous pattern (7 patients), burst suppression pattern (2 patients), low voltage pattern (1 patients). Seven patients (28%) had periods of seizure activity. Three (12%) patients who shown the burst suppression and low voltage pattern had severe neurologic complications at discharge period.

Conclusions: Continuous cerebral monitoring with the aEEG provides the simplified information. The aEEG is feasible for bedside neuromonitoring during ECMO support in both pediatrics and adults.

Keywords: Extracorporeal membrane oxygenation, Neurologic injury, Electroencephalogram
ANTICOAGULATION IN PATIENTS ON EXTRACORPOREAL MEMBRANE OXYGENATOR (ECMO); NAFAMOSTAT MESILATE VERSUS HEPARIN

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Background/Purpose: Heparin is the main anticoagulant in patients on Extracorporeal membrane oxygenator (ECMO). Nafamostat mesilate, anticoagulant used in continuous veno-venous hemodialysis seems increasing in usage as a substitute of heparin in ECMO patients due to its short half-life. We aim to compare two anticoagulants regarding bleeding complications and anticoagulant effect.

Methods: 320 patients had veno-arterial ECMO support from January 2005 to November 2014. Among them, Heparin was used in 201 patients (Heparin group) while Nafamostat mesilate was used in 119 patients (Nafamostat group). Infusion dose of each anticoagulant was adjusted by target activated coagulation time (ACT; 160-200 sec) or activated partial thrombin time (aPTT; 50-70 sec). Primary endpoint was thromboembolic or bleeding complication during ECMO support. Multivariate analysis was performed for each complication. Propensity score matching analysis was used to compare groups.

Results: Mean age of patients was 58.3±15.4 years. Mean duration of support was 111±101 hours. Early mortality was 57%. Bleeding complication occurred in 14 patients (7.0%) in Heparin group and 15 patients (12.6%) in Nafamostat group. Nafamostat use was the only significant risk factor for the bleeding complication (Hazard Ratio (HR) 2.4, Confidence Interval (CI) 1.07-5.36, p=0.032), Propensity matching analysis showed higher bleeding rate in Nafamostat group (p=0.037). Regarding thromboembolic complication, there was no statistical significance between two groups. (p=0.12)

Conclusions: Nafamostat mesilate demonstrated higher bleeding complication compared to Heparin in patients on ECMO without increasing thromboembolic complication. In patients with bleeding tendency, heparin can be more safely used as anticoagulant during ECMO support. Further study in larger cohort will be needed.

Keywords: Extracorporeal membrane oxygenator, Nafamostat mesilate, Heparin
SYSTEMATIC TRAINING OF ECHOCARDIOGRAPHY IN ICU IS EFFECTIVE

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Background/Purpose: We reported the efficacy of simple systematic point-of-care pocket-sized echocardiography (POCKET) training for ICU residents during one-month rotation.

Methods: Ten consecutive ICU residents were evaluated. An ICU doctor lectured POCKET for all residents as same protocol during one month of ICU rotation. First week, they were lectured POCKET by using mobile phone application (FOCUS Pocket Guide, CAE Healthcare Inc.) for about 30 minutes. After the lecture, the ICU doctor demonstrated POCKET on an actual patient and let residents to carry it out by themselves for about 30 minutes. Residents are recommended to perform POCKET frequently on their daily ward rounds and the ICU doctor advised them at bed-side accordingly. In the fourth week, the evaluation were conducted, the residents was expected to obtain POCKET images on actual patient. All The images were graded as bad, fair, or good by an ICU doctor.

Results: All images of the left sternal long and short axis, and the inferior vena cava were graded as good or fair. The images of apical four-chamber view and sub-costal four-chamber view which were graded as bad were 44% and 33%.

Conclusions: During ICU rotation for one month, residents can master POCKET by simple systemic echocardiographic training.

Keywords: Point-of-care echocardiography, Mobile phone application
HEAT MOISTURE EXCHANGER MIGHT REDUCE THE FRESH GAS FLOW DURING PREOXYGENATION

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Background/Purpose: Preoxygenation is relevant procedure before facilitating intubation safely. During induction, some may provide oxygen through heat moisture exchanger (HME) connected with corrugated tube. And it would be provided with 0cmH2O of adjustable pressure limiting valve. Under this condition, the increasing resistance of circuit may decrease oxygen flow than we set. Accordingly, we conducted experimental study to observe real oxygen flow under various oxygen set flows and sizes of HME.

Methods: We used Datex Ohmeda Aisys pro as anesthetic machine with 0cmH2O of APL valve. We observed the oxygen flow using three different sizes of HME including for neonate, pediatric and adult patients, and compared those with no HME. Real oxygen flow was observed using FlowAnalyser PF-300 (Imtmedical, Switzerland). The oxygen flow (each of 1L/min between 1 and 10L/min) and conditions of HME was provided following the computer generated randomization. P-value<0.05 was considered as statistical significance.

Results: We observed six circuits for each of four condition of HME with ten different setting of oxygen flows; totally 240 measurements. Figure shows the mean observed oxygen flow in four conditions. Without any HME, oxygen flow was significantly decreased when the setting of oxygen flow was <= 8L/min. With HME for neonate and pediatric patients, oxygen flow was significantly decreased when setting flow was <=5L/min. With HME for adult patients, oxygen flow was significantly decreased, when the setting was <=6L/min.

Conclusions: During preoxygenation with HME, the real oxygen flow might be less than we set, especially with HME and the higher setting of oxygen flow.

Keywords: Oxygen flow, Heat moisture exchanger, Pre-oxygenation
EVALUATION OF KEY WORDS CITED IN PUBLICATIONS RELATED TO CRITICAL CARE

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Background/Purpose: Key words enable authors to extend the representation of manuscript content beyond that presented in the title and abstract. In addition, key words impact the retrievability that can contribute to the frequency with which a publication will be cited. The objective of this study was to evaluate the key words in publications related to critical care.

Methods: Articles published in the American Journal of Respiratory and Critical Care Medicine (AJRCCM), Critical Care Medicine (CCM), Intensive Care Medicine (ICM), and Journal of Critical Care (JCC) from 2013 to 2014 were manually reviewed to identify the key words. We selected 50 articles from each journal and compared the key words to the medical subject heading (MeSH) terms. In addition, we studied whether PubMed searches using the key word yielded the original article.

Results: The 200 selected articles used a total of 982 key words. The total number of key words that were consistent with the MeSH database was 498 (50.7%). The number of MeSH-compatible key words increased with the journal’s impact factor (AJRCCM: 63.0%, CCM: 57.4%, ICM: 42.6%, JCC: 41%). A key word-based PubMed search showed that 26% of key words did not yield the original article. Such key words were used two or less times in the text of the manuscript.

Conclusions: To optimize literature search retrievability, MeSH-compatible terms should be used as key words and should frequently be included in the text of manuscripts.

Keywords: Medical subject headings, Critical care, Key words
EVALUATING THE FCCS IN CRITICAL CARE EDUCATION IN JAPAN: THE SURVEY OF JAPANESE FCCS INSTRUCTOR

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Background/Purpose: The Fundamental Critical Care Support (FCCS) course has been introduced after minimal adaption according to Japanese clinical settings. The purpose of this study is to evaluate whether Japanese FCCS course is useful and has a possibility to be a basis of critical care management in Japan by the survey of Japanese FCCS instructor.

Methods: The course program was provided with the form of lecture and skills stations. Pre-and post-training knowledge was assessed. Then, FCCS instructors (n=51) also were asked to fill out the some questions about the usefulness of this FCCS course in critical care education in Japan.

Results: The number of participants increased year after year and reached 2200 during the past 4 years. Nearly 70% of participants were physicians. Most of the others were nurses. Regarding useful sessions, nearly half of the participants thought that mechanical ventilation (MV) was most useful. Then, more than 80% of FCCS instructors thought that they were known some misunderstand after becoming the FCCS instructor. They thought that mechanical ventilation (MV) was most useful and they changed the MV setting in clinical practice after becoming the FCCS instructor.

Conclusions: It is considered that Japanese FCCS course is useful and has a possibility to be a basis of critical care management in Japan. Therefore, it is reasonable to think that Japanese FCCS mission has been successfully achieved.

Keywords: Education, Simulation training, Fundamental critical care support
NAGOYA SURVEY ON CRITICAL CARE EDUCATION DESIRED OF RESIDENTS

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Background/Purpose: It is quite important to let residents and medical students understand the critical care field owing to their selections of the future advanced medicine. Our emergency and critical care department has launched the systemic education for residents with the comprehensive conference and the medical treatment bundles including the management of sepsis and immunity. We think the education of critical care is an important issue through the clinical careers of residents.

Methods: We executed the questionnaire consisting of 23 questions for 29 junior residents in Nagoya University Hospital and received 21 replies.

Results: Those who want to choose the practice in ICU during the senior resident course were 5 (24%). Popular desires of residents were catecholamine usage (90%), nutrition control (86%), and the management of non-invasive positive pressure ventilation (86%). More than 11 residents (50%) actively answered their hopes in acquiring the skills and knowledges in the critical care. On the other hand, 7 residents (33%) answered no interests in the critical care medicine regardless of no clinical experiences in ICU.

Conclusions: In this survey, it will be announced what the medical residents expect of the critical care course in Nagoya, Japan. While meeting their expectations, we should provide the sufficient critical care learning programs based on our clinical evaluations.

Keywords: ICU, Education, Resident
DEVELOPMENT OF A UNIQUE MANAGEMENT IN A LOCAL EMERGENCY HOSPITAL

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Background/Purpose: It is one of the current problems in Japan to develop each of local area-based health care systems to cope with the coming unprecedented ageing society. We here introduce our efforts by developing medical cooperation and team care under a slogan of first aid not to decline.

Methods: We triaged the emergency patients quickly and transferred some of them to a highly advanced medical center as needed. When treatment for patients in an acute period terminate in the highly advanced medical institution, we went to receive them by our own ambulance and they were admitted in our hospital and underwent a sub-acute phased therapy, including minor surgery and endoscopic gastrotomy. Function recovery rehabilitation was daily continued immediately after hospitalization. The staff of Department of Secretary is concerned with an above-mentioned whole process.

Results: As result of such efforts, front support results increased from 41 cases (2012) to 78 cases (2013), 153 cases (2013), and 237 cases (2014). In addition, the number of emergency acceptance increased from 441 cases (2012) to 866 cases (2013), 863 cases (2013), and 1045 cases (2014). Number of operations and examinations increased as well. The hospital management turned a profit.

Conclusions: Confidence of local inhabitants for our hospital has increased. It has suggested that our action of medical cooperation and team care will be able to improve in part medical problems in the super aging society in Japan.

Keywords: Emergency, Management, Secretary
THE IMPACT OF INTRODUCING EMERGENCY DEPARTMENT CRITICAL CARE COMMITTEE

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Background/Purpose: Hamad General Hospital (HGH) is the main tertiary referral teaching government Hospital in Qatar. The Emergency Department (ED) sees about 1500 patients per day. The 17-bed Adult Medical Intensive Care Unit (MICU) admits 1600 patients a year. The ED has a large resuscitation capacity which can take up to 25 patients, and often becomes the overflow area for admitted MICU patients. New resuscitation cases and relatively stable critically ill patients are managed in the same clinical area. There can be up to 10 MICU patients in the ED awaiting admission. There are plans for significant expansion for both departments. With the rapid rate of population growth in Qatar, it is expected that the current clinical need will increase for the foreseeable future. Physicians with dual expertise and formal training in Emergency Medicine and Critical Care Medicine are a relatively new concept, and are expected to play an important part in this complex ED-MICU crossover setting. Emergency Department Critical Care Committee (EDCCC) directly reports to the ED chairman. It is anticipated to be the main initial key strategy in managing the risk, and to further oversee initiatives to improve care of critically ill patients.

Methods: Review of EDCCC activities from March 2013 until March 2015

Results: The advantages of a focused committee were demonstrated by identification and improvements in the following areas, see table attached.

Conclusions: The EDCCC team lead by a physician with responsibilities in both ED and MICU departments has generated initiatives to improve the care of critically ill patients in the ED.

Keywords: Emergency department critical care committee
THE NOMOGRAM; VISUALIZATION OF PROBABILITY FOR OUT-OF-HOSPITAL CARDIAC ARREST

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Background/Purpose: Therapeutic hypothermia is a key component of treating arrest patients to reduce brain injury as AHA already recommends as class I for out-of-hospital cardiac arrest survivors with ventricular fibrillation or pulseless ventricular tachycardia and class IIb for OHCA survivors with non-shockable rhythm or in-hospital cardiac arrest. However, many TH-related issues have yet to be sufficiently resolved. Emergency physicians always face a main question what prediction of resuscitated patients with ROSC is. As of now, reality is just saying ambiguous prediction. However, if we use a nomogram, physician can understand probability that simultaneously considers various factors, not single odds ratio.

Methods: The Korea Hypothermia Network managed a web-based retrospective registry of cases of OHCA treated with TH. Adult (≥18 years) comatose patients treated with TH between January 2007 and December 2012 were included. Cases of cardiac arrest from trauma or stroke or that occurred in the hospital were excluded. We performed a logistic regression using prehospital variables of KORHN registry to predict a good neurologic outcome (CPC 1,2).

Results: According to selected logistic model by backward method, significant variables are previous CPC status, history of DM, presence of witness, shockable rhythm on scene and ED, time interval to ROSC and cause of arrest. We plot odds ratio based on selected model and draw a nomogram (Fig 1, 2) using R (R version 3.1.3).

Conclusions: We conclude that a nomogram could be an interesting visualizing tool for physicians, and it shows providing airway devices during transportation to ED might be discouraged.

Keywords: Cardiac arrest, Nomogram, Prediction

![Figure 1](image1.png)  ![Figure 2](image2.png)
A SURVEY OF DIFFICULT INTUBATION AND CANNOT INTUBATION, CANNOT VENTILATE SITUATIONS IN KOREA

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Background/Purpose: There was no survey of airway management strategies for difficult intubation and cannot intubation, cannot ventilate (CICV) situation in Korea. This study was intended to determine devices or methods that Korean anesthesiologist and intensivist prefer in difficult intubation and CICV.

Methods: This study was intended to determine devices or methods that Korean anesthesiologist and intensivist prefer in difficult intubation and CICV. Using face to face survey that consisted of their preference, experience and comfort level for alternative airway management devices, we asked anesthesiologist and intensivist at study meetings and conferences from October to December 2014.

Results: We could get two hundred eighteen questionnaires. In the difficult intubation, the order of preferred alternative airway devices was videolaryngoscope (52%), optical stylet (23%), laryngeal mask (11%) and fiberoptic bronchoscopy (11%). Seventy six (35%) of 218 respondents had met a CICV situation, and most of cases were elective surgery. In CICV situation, preferred methods of infraglottic airway management were cricothyroidotomy by IV catheter (57%), tracheostomy by surgeon (19%), cricothyroidotomy by wire-guided (19%), cricothyroidotomy by bougie (3%), and cricothyroidotomy by open surgery (2%). Ninety eight (45%) of 218 respondents were familiar with American Society of Anesthesiologists’ difficult airway algorithm, and only forty three (20%) had participated in airway workshops within the past five years.

Conclusions: In conclusion, videolaryngoscope was the most preferred device in a difficult airway. In a CICV situation, the method of cricothyroidotomy by IV catheter was the most frequently used, followed by tracheostomy by surgeon.

Keywords: Difficult intubation, Cannot intubation, Cannot ventilation
CLINICAL SIGNIFICANCE OF RDW CHANGE IN PATIENTS WITH COMMUNITY-ACQUIRED PNEUMONIA

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Background/Purpose: It has been reported that red cell distribution width (RDW) is associated with mortality in patients with community-acquired pneumonia (CAP). However, little is known about the effect of RDW change during treatment on mortality. Thus, the objective of this study is to evaluate the association between RDW change during treatment and mortality in hospitalized patients with CAP.

Methods: From Apr 2008 to Feb 2014, retrospective analyses of medical records of patients who were hospitalized for CAP were performed. Laboratory values including RDW (from day 1 to 4), clinical variables and the pneumonia severity index was abstracted. The deltaRDWn-1 was defined as change of RDW and was calculated from (RDWday1-RDWday-n)/RDWday1, where day-n means hospital day.

Results: During the study period, a total of 1069 patients were hospitalized for CAP. Mortality at 30 day was 100/1069 (9.4%). Median RDW at baseline was 14.1% (range 11.1 to 30.2) and was significantly different between survivors and non-survivors (p<0.05). There were 470 patients with available serial RDW data (30-day mortality 58/470 (12.3%)). Of those patients, age, PSI score, BUN, total protein, albumin, RDW at day 1 and the RDW4-1 were significantly different between survivors and non-survivors in univariate analysis. In multivariate Cox regression analysis showed that the significance of the relationship between deltaRDW4-1 and 30-day mortality risk was sustained after adjusting for age, PSI score, RDW at day 1, total protein and initial albumin.

Conclusions: Change of RDW from day 1 to day 4 was the independent predictor of mortality in patients with CAP.

Keywords: Red cell distribution width, Delta RDW, RDW change, Community-acquired pneumonia
PRE-MORBID GLUCOSE CONTROL MODIFIES THE INTERACTION BETWEEN HYPOGLYCEMIA IN ICU AND MORTALITY; MULTICENTER MULTINATIONAL STUDY

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Background/Purpose: Relationship between hypoglycemia and outcomes in critically ill patients was reported in various studies. However, there is little study to assess the interaction of pre-morbid glucose control on the relationship between hypoglycemia and outcomes.

Methods: We performed a multicenter multinational retrospective observation study of patients with HbA1c levels measured within three months before ICU admission. The primary outcome was hospital mortality. We defined a moderate hypoglycemia as 40-69mg/dL and severe hypoglycemia as <40mg/dL. To study interaction of pre-admission HbA1c, we used logistic regression models. A two-sided p-value of 0.05 was considered to be statistically significant.

Results: There were 3,084 critically ill patients with 48,980 blood glucose measurements in our study cohort. There was 469 patients with high pre-admission HbA1c (≥8%), 588 patients with moderate pre-admission HbA1c (6.5-7.9%) and 2,027 patients with low pre-admission HbA1c (<6.5%). The hospital mortality in total cohort was 8.9 %. In each cohort according to pre-admission HbA1c, severity of hypoglycemia was significantly associated with increased mortality (p<0.001) (figure). In multivariate logistic analysis for hospital mortality, there was a significant interaction between pre-admission HbA1c and association between hypoglycemia in ICU and hospital mortality (p=0.01), which indicated that patients with higher pre-admission HbA1c had stronger relationship between hypoglycemia with mortality than those with lower or moderate pre-admission HbA1c (table).

Conclusions: There was a significant interaction between pre-existing hyperglycemia and association between hypoglycemia in ICU and mortality. This finding might suggest that hypoglycemia in ICU is more dangerous in patients with higher pre-admission HbA1c than those with lower HbA1c.

Keywords: Hypoglycemia, Pre-morbid glucose control, Interaction

<table>
<thead>
<tr>
<th>HbA1c</th>
<th>Glu&lt;40mg/dL (vs. 40-69mg/dL)</th>
<th>Glu≥70mg/dL (vs. 40-69mg/dL)</th>
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<tbody>
<tr>
<td>&lt;6.5%</td>
<td>3.00 (0.72, 12.4)</td>
<td>1.82 (0.84, 3.94)</td>
</tr>
<tr>
<td>6.5-7.9%</td>
<td>2.32 (0.47, 11.4)</td>
<td>1.25 (0.52, 3.01)</td>
</tr>
<tr>
<td>≥8.0%</td>
<td>5.05 (1.22, 21.0)</td>
<td>0.27 (0.1, 0.69)</td>
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CORRELATION BETWEEN CENTRAL OBESITY AND HYPERTENSION AMONG ADOLESCENTS IN DENPASAR DISTRICT, BALI PROVINCE, INDONESIA

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Background/Purpose: The prevalence of early aged hypertension is increasing due to prominence sedentary lifestyle among adolescents. This resulted in increasing risk of central obesity (CO). There is very little evidence documenting the correlation between CO and hypertension among adolescents, particularly from developing countries. This study was aimed to explore the correlation between CO and hypertension among adolescents in Denpasar District, Bali Province.

Methods: A cross-sectional study with a total sampling of 431 adolescents (aged 12-14 years) was conducted. Adolescents found to have chronic diseases and underwent hypertension treatment were excluded from the study. Data collected were including: gender, waist circumference, CO status, body mass index (BMI), systolic blood pressure, diastolic blood pressure, and family history. Data were analyzed using univariate and bivariate analysis (chi square test with cramers v).

Results: The prevalence of hypertension among adolescents is 30.2%. The mean of systolic blood pressure is 117 mmHg (SD=12.6 mmHg) and diastolic blood pressure is 70.8 mmHg (SD=10.5 mmHg). There is a significant difference of hypertension among adolescents based on CO status (46.5% vs 25.2%; p<0.05). A weak positive correlation between CO and hypertension among adolescents is documented (0.2; p=0.0001). Adolescents with CO and having a family history of hypertension are more likely to develop hypertension than those who have not (0.25; p=0.004).

Conclusions: There is a weak positive correlation between CO and hypertension among adolescents. These findings can be used to inform prevention measures for both CO and hypertension among adolescents to avert the epidemic of cardiovascular diseases.

Keywords: Central obesity, Hypertension, Adolescent
BODY FAT, WAIST-TO-HIP RATIO, AND WAIST-TO-HEIGHT RATIO ARE ASSOCIATED TO CENTRAL OBESITY AMONG ADOLESCENTS IN DENPASAR DISTRICT, BALI PROVINCE, INDONESIA

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Background/Purpose: Central obesity (CO) is the major risk factors of metabolic syndrome among adolescents. Early aged of metabolic syndrome will increase the risk of degenerative diseases such as diabetes mellitus and cardiovascular disorders. This study was aimed to examine risk factors of CO among adolescents in Denpasar District, Bali Province.

Methods: A cross-sectional study with a total sampling of 431 adolescents (aged 12-14 years) was conducted. Adolescents found to have chronic diseases and underwent hypertension treatment were excluded from the study. Data collected were including: gender, hip circumference, waist circumference, central obesity status, body fat percentage, waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), body mass index (BMI), and family history. Data were analyzed using univariate and bivariate analysis (independent sample t-test and chi square test).

Results: The prevalence of CO among adolescent is 24%. The average of WHR and WHtR are 0.84±0.06 and 0.50±0.08. About 30.6% of sample was found to have excessive body fat. An excessive body fat increases the risk of CO as many as 1.18 (95% CI: 1.07-1.31) and WHR above 0.81 were found to increase CO as many as 1.06 (95% CI: 0.96-1.18). WHtR above 0.42 increases the risk of CO as many as 1.15 (95% CI: 1.04-1.27).

Conclusions: An excessive body fat, higher WHR, and higher WHtR are associated to increasing risk of having CO among adolescent. Findings from this study indicate the need of multi-faceted interventions aiming at reducing sedentary lifestyle from early age.

Keywords: Central obesity, Adolescent, Body fat, Waist-to-hip ratio, Waist-to-height ratio
EMERGENCY TRACHEAL INTUBATION IN GENERAL HOSPITAL: AN OBSERVATIONAL STUDY

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Background/Purpose: Tracheal intubation using video laryngoscopy (VL) has been shown to decrease airway-related complications compared with direct laryngoscopy (DL). However, there are limited data on the effectiveness of the VL among emergent non-operative intubation. We seek to determine whether emergency intubation using VL is associated with a decrease risk of airway-related complications in these patients.

Methods: We conducted a single center prospective cohort study between July 2012 and June 2014. All consecutive patients who underwent emergency intubation with VL or DL in emergency department (ED) and intensive care units (ICU) were included. Patients who underwent surgical airway management were excluded. After each intubation efforts, the operator completed a standardized data collection form. The primary exposure was the emergency intubation using VL. The primary outcome was the occurrence of airway-related complication. We determined the associations between VL and airway-related complications by using multivariable logistic regression.

Results: A total of 399 patients were included in the analysis. 138 patients (33.6%) were intubated using VL. 131 patients (31.8%) had airway-related adverse events (hypotension 13.6%, hypoxia 7.8%, esophageal intubation 6.1%, dental/ lip/airway trauma 5.8%, mainstem bronchus intubation 4.9%, regurgitation 1.9%, dysrhythmia 1%, cardiac arrest 1%). After adjusting for age, sex, body mass index, indication of intubation, method of intubation and first intubator, VL was not associated with a decreased risk of airway-related complications (OR 1.0; 95% confidence interval 0.6 to 1.6).

Conclusions: Hypotension and hypoxemia were common in hospitalized patients. VL was not associated with a decrease risk of airway-related complications in hospitalized patients.

Keywords: Emergency intubation, Complication, Patient safety
INCIDENCE OF CARDIOPULMONARY ARRESTS AFTER IMPLEMENTATION OF A RAPID RESPONSE SYSTEM DURING OPERATION TIME VS NON-OPERATION TIME

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Background/Purpose: Rapid response systems (RRSs) are considered an important tool for improving patient safety. We studied the effect of an RRS on the incidence of cardio-pulmonary arrests (CPAs).

Methods: We performed a retrospective before-after analysis of the CPAs in a 1,360-bed tertiary care hospital from January, 2009 to October, 2014. We included 176,193 admissions before and 117,822 admissions after implementing the RRS on October, 2012. The operation time of the RRS was from 7 am to 10 pm during weekdays. The primary outcome was CPA incidence, which was expressed as the case per 1,000 admissions.

Results: The overall CPA incidence was 1.31. Although the number of admission per month and the case-mix index were increased (3915.4 vs. 4712.9, p=<0.001; 1.0923 vs. 1.1255, p=0.003, respectively), the CPA incidence was significantly decreased (1.66 vs. 1.25, p=0.03), and there was no detectable changes on the mortality (1.27 vs. 1.33, p=0.273). The CPA incidence in the surgical department was significantly reduced (1.13 vs. 0.38, p=0.014), however, the reduction of the CPA incidence in the medical department was insignificant (3.93 vs. 2.97, p=0.075). The implementation of the RRS did not reduce the CPA incidence during non-operation time (0.80 vs. 0.73, p=0.573), but decreased during operation time (0.86 vs. 0.52, p=0.001). The immediate survival rate (76.9% vs. 67.2%, p=0.034) during the operation hours of the RRSs was better than during the non-operation hours.

Conclusions: The implementation of the RRS reduced the CPA incidence, which was originated in the reduction of the CPA during the operation hours.

Keywords: Rapid response team, Cardiac arrest, Outcome
HOW MUCH DO FAMILY MEMBERS SATISFY WITH THE INTENSIVE CARE UNIT IN SOUTH KOREA?

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Background/Purpose: Meeting the needs of family members of patients in the intensive care unit (ICU) is an important aspect of patient- and family-centered care. Lack of qualitative research on the ICU experience in South Korea hastens quality improvement. We evaluated the family members ICU experience.

Methods: We developed a survey asking the family members about their ICU experience, which evaluated the 3 major outcomes: (1) understanding of general information on ICU, (2) understanding of medical status of ICU patient, and (3) satisfaction of information received. The mean score of three outcomes, which represent overall family satisfaction with the ICU care, was calculated for each variable. The study was conducted at the medical ICU from August, 2014 to February, 2015.

Results: One hundred three surveys were returned. The satisfaction of information received had highest score(79.8±20.6), followed by understanding of medical status of ICU patient(76.0±19.4), and understanding of general information(58.5±23.9). The score of overall family satisfaction was 71.0±16.7. The family members who need financial support and want meetings with social workers and the patient age over 70 year-old were associated with lower overall family satisfaction. The use of renal replacement therapy decreased the understanding of medical status of the ICU patient. The APACHE score over 25 decreased the understanding of general information on ICU. Multi-variate analysis revealed the patient’s age was significantly associated with decreased overall family satisfaction.

Conclusions: The age of the patient was an only significant factor associated with decreased family satisfaction. Further researches using validated questionnaire are essential to improve the family members ICU experience.

Keywords: Family, Satisfaction, Needs, Support
CLINICAL CHARACTERISTICS AND OUTCOMES OF THE MEDICAL EMERGENCY TEAM ACTIVATION IN OBSTETRIC PATIENTS

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Background/Purpose: The critical illness of peripartum women results a fatal problem. We investigated reasons for activation of a medical emergency team (MET) and the outcomes in obstetric patients.

Methods: The 65 patients activated by a MET in obstetric patients were reviewed from March 2008 to December 2014.

Results: Mean age was 33.7 years (range 25~41) and the 55 patients (84.6%) were the postpartum state. 49 patients (75.4%) of a MET activation were triggered by the doctors direct call and the 7 patients (10.8%) were by the electronic medical record based screening system. The commonest triggering factors of a MET in peripartum patients were respiratory distress (n=30, 46.2%) and hypovolemic shock (n=14, 21.5%). The MET performed endotracheal intubation (n=13, 20.0%), central line insertion (n=26, 40.0%) and arterial line insertion (n=16, 24.6%). The 16 patients (24.6%) were treated as arterial embolization and the 14 patients (21.5%) were performed operation. The 47 patients (72.3%) were treated in the general wards and the 18 patients (27.7%) were transferred to the intensive care unit (ICU). Among patients transferred to the ICU, the most common cause of a MET activation was respiratory distress (n=11, 61.1%). And in-hospital mortality rate was 3.1% (n=2).

Conclusions: We observed that the most common cause of a MET activation in obstetric patients was respiratory distress and in these patients the survival rate is high.

Keywords: Medical emergency team, Obstetric patients, Respiratory distress
IMPACT OF POSITIVE FLUID BALANCE AND LARGE AMOUNT OF DIURETICS ON THE PROGNOSIS IN CRITICALLY ILL PATIENTS

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Background/Purpose: In spite of the importance of early fluid resuscitation, overloaded fluid accumulation may increase mortality of patients in intensive care unit (ICU). Commonly, we use diuretics and control fluid balance. The aim of this study is to find relationship between mortality and fluid balance and loop diuretics dosage in ICU.

Methods: Following retrospective review of medical records of 729 adult patients admitted in medical and emergency ICU from March to August, 2011, 650 patients under intensive care were enrolled. We compared the deceased patients (Group D) with the patients discharged alive (Group A) from ICU.

Results: Among 97 patients (14.9%) who died, 61 patients (62.9%) were male. The most common causes of death were septic shock (25.8%) and pneumonia (21.6%). Positive fluid balance of Group D and A on the first ICU day were 1608.0±281.2 mL and 864.7±78.6 mL (p=0.057). Positive fluid balance of Group D and A during total ICU days were 7007.3±814.3 mL 1777.1±215.6 mL (p<0.001). Dosage of loop diuretics during first day and total ICU days, and average daily dosage were significantly increased in group D (p=0.002, p<0.001, and p<0.001). APACHE II score was associated with positive fluid balance and used dosage of loop diuretics in ICU on the first, second, third day and total ICU days.

Conclusions: In our study, deceased patients had lots of fluid intake and loop diuretics in ICU. High positive fluid balance and high dosage of loop diuretics do not only reflect patients severity but also influence poor prognosis even mortality with a lasting overbalance.

Keywords: Fluid balance, Loop diuretics, ICU
THE INCREASING LENGTH OF STAY OF THE ACUTE CORONARY SYNDROME PATIENT WITH ACUTE KIDNEY INJURY IN ICVCU NATIONAL CARDIOVASCULAR CENTER HARAPAN KITA JAKARTA INDONESIA

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Pusat Jantung Nasional Harapan Kita, Department of Cardiology and Vascular University of Indonesia, Indonesia

Background/Purpose: On the admission, patients in intensive care unit with acute coronary syndrome rarely have any symptoms on the urinary tract. However on the blood test results, patients get into acute kidney injury condition. However, not all physicians are aware on this and may endanger patients without prompt management. The aim this research was to find the outcome of the patients who had AKI on the Acute Coronary Syndrome in the ICVCU.

Methods: The outcome was measured with the length of stay in the ICVCU (the period of time patients remain in the hospital) and hospital length of stay (the period of time patients remain in the hospital). The research was conducted on September 2014 until March 2015 in ICVCU National Cardiovascular Center Harapan Kita Jakarta, Indonesia. The sample was 366 patients diagnosed with ACS which is grouped into ACS with AKI and ACS without AKI. The method used was cross sectional with consecutive sampling technique.

Results: The results showed that 30.05% patients admitted in ICVCU with ACS were also diagnosed with AKI. The average length of stay in ICVCU of patients without AKI was 3.4 ± 3.4 days and with AKI was increased significantly to be 4.8 ± 6 days (p=0.007). The Hospital length of stay patients without AKI was 7.9 ± 8 days and the patients with AKI was increased significantly to be 10.1 ± 10 days (p=0.017).

Conclusions: This research concluded that the presence of AKI increased the length of stay either the ICVCU length of stay or hospital length of stay.

Keywords: Length of stay, Intensive cardiovascular care unit, Acute coronary syndrome, Acute kidney injury
A PROSPECTIVE STUDY ON THE INCIDENCE AND CLINICAL FEATURES OF DELIRIUM USING THE KOREAN VERSION OF DELIRIUM RATING SCALE-REVISED-98(K-DRS-R98) IN CRITICALLY ILL PATIENTS

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Background/Purpose: Delirium is common and major complication among critically ill patient in Intensive care units (ICUs). CAM-ICU is generally accepted as a powerful tool to screen and assess delirium in the ICU. The aim of this study was to examine the incidence, severity, and clinical outcome of delirium using the Korean version of delirium rating scale-revised-98(K-DRS-98) in adult patients with acute respiratory failure who were functionally normal prior to hospitalization.

Methods: For this study, we designed a prospective observational study and retrospective analysis in a single tertiary hospital. All adult patients with acute respiratory failure were screened in one medical-surgical ICU by CAM-ICU daily from 31th March, 2014 to 1st October 2014. The subject with newly developed delirium was examined by a psychiatrist using K-DRS-R98 and SCIRS(Severe Cognitive Impairment Rating Scale) at 1st day, 3rd day, 7day after diagnosis and 7th day after ward transfer. We collected and reviewed the medical records: demographic data, etiology of ICU admission, the clinical outcomes, Severity scores such as APACHE-II, SOFA, and K-DRS-R98 assessment.

Results: 67 of 265 patients screened were eligible to be examined. 25 of 67 (37.3%) were diagnosis with delirium. Mean age of the subjects was 73.1 years. The number of patients with mechanical ventilator support, severe sepsis or septic shock, and ARDS was 19 (76.0%), 19(76.0%), and 11 (44.0%) respectively. The severity score by APACHE-II was 25.9 and the average of ventilator free days was 13.3 days. The severity and total score using K-DRS-R98 were 19.4 and 26.4 at the date that delirium occurred. After 7 days, the re-examination of K-DRS-R98 showed 17.3 and 23.7 in severity and total score. Specially short-term memory impairment in 16 items of K-DRS-R98 have not recovered even a week later.

Conclusions: This study suggested that K-DRS-R98 might be useful to identify the feature of delirium in adult patients with respiratory failure in our Korean dataset.

Keywords: Delirium, Delirium rating scale, Acute respiratory failure, ICU, Incidence
FACTORS EFFECT LENGTH OF STAY AND MORTALITY IN INTENSIVE CARE UNIT

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Background/Purpose: The purpose of this study was to evaluate the length of intensive care unit (ICU) stay, and determine the factors that influence the mortality.

Methods: 645 patients who died in the Emergency Intensive Care Unit from January 1, 2001 to December 31, 2010, were retrospectively analyzed. Age, gender, Glasgow coma scale (GCS), APACHE II (Acute Physiology And Chronic Health Evaluation) and modified APACHE II scores (for pediatric patients only), length of ICU stay (LOS), diagnosis, comorbid diseases and stay periods of the patients were evaluated.

Results: This study included 645 patients, of whom 386 (59.8%) were male, 271 (42%) were aged over 65 years and 481 (74.6%) were patients with medical admission. Mortality percentage was 24.3%. Acute respiratory failure was the most frequent diagnosis with 176 patients. LOS was between 0.01 and 118 days with the median value of 7.91 ±11.59 days. LOS ≤ 1 day, 1-4 days, 5-9 days, and ≥10 days were respectively 33.3%, 21.3%, 17%, and 28.2%. Diagnosis is strongly associated with the LOS, the median was 1 day in post CPR patients, and 7 days in intoxication. Co-morbidity of malignancy was the most common one in 182 patients and was determined to decreased the LOS. APACHE II were confirmed to be inversely proportional to LOS. Admission diagnosis and mortality rates in years summarized in the table.

Conclusions: Diagnosis is associated with the length of stay. Post CPR patients have shorter length of stay. Patients with malignancy and higher APACHE II scores have shorter LOS. Elderly patients have higher mortality rate.

Keywords: APACHE II, length of ICU stay, Mortality

<table>
<thead>
<tr>
<th>Table: Admission diagnosis, and mortality in years</th>
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<td>n (%)</td>
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<td>2001</td>
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</tr>
<tr>
<td>Acute cardiovascular diseases</td>
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<td>5 (7.7)</td>
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<td>Acute neurologic diseases</td>
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<td>6 (9.2)</td>
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<tr>
<td>Acute respiratory failure</td>
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<td>20 (30.8)</td>
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<td>Hypovolemic shock</td>
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<td>1 (1.5)</td>
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<tr>
<td>Intoxications</td>
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<td>1 (1.5)</td>
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<tr>
<td>Massive bleeding</td>
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<tr>
<td>3 (4.6)</td>
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<tr>
<td>Post CPR</td>
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<tr>
<td>7 (10.8)</td>
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<tr>
<td>Sepsis</td>
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<td>6 (9.2)</td>
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<td>Trauma</td>
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<td>7 (10.8)</td>
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<tr>
<td>Burns</td>
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<td>29.8</td>
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</table>

Mortality rates
INTENSIVISTS PERCEPTIONS OF UNCONSENTED HIV TESTING IN SOUTH AFRICAN ICUS

Dhivendra Singh
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Background/Purpose: HIV testing in critically ill patients presents an ethical dilemma as a result of stigma attached to the diagnosis. Legal guidelines require fully informed consent. However little guidance is given in the case of incapacitated patients who cannot consent but who may benefit from directed therapy. There is therefore an ethical conflict for intensive care physicians between acting in the best interests of the patients and breaching autonomy. The aim of the study was to ascertain intensivists’ practices and perceptions of unconsented diagnostic HIV testing in ICUs and disclosure of results.

Methods: The study was a descriptive cross-sectional survey. A structured online questionnaire was emailed to 47 intensivists at university hospital ICUs. The questionnaire probed the following aspects: The presence of testing protocols, whether clinicians were comfortable with unconsented HIV testing, whether they considered it ethical and whether they considered current guidelines relevant or in the patients’ best interest. In addition the questionnaire asked for opinions regarding surrogate consent, confidentiality and disclosure of results.

Results: The response rate was 51%. The majority of ICUs did not have a policy or protocol in place. The majority of respondents considered unconsented HIV testing ethical and were of benefit to the patient. The majority felt that surrogate consent for testing was neither reliable nor acceptable.

Conclusions: Unconsented testing for HIV is regarded as ethical by intensivists, and is in the patient’s best interests despite a breach in autonomy.

Keywords: HIV, Unconsented testing, Autonomy, Benefit
Clinical Medicine - Geriatric Medicine

CLINICAL CHARACTERISTICS AND OUTCOMES OF VERY ELDERLY CRITICALLY ILL PATIENTS IN A MEDICAL INTENSIVE CARE UNIT OF A SINGLE TERTIARY HOSPITAL IN KOREA

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Background/Purpose: This study evaluated clinical characteristics and outcomes in very elderly (≥80 years of age) critically ill patients admitted to a medical ICU in a regional single tertiary hospital.

Methods: We retrospectively evaluated prospectively collected data in the medical ICU of Gyeongsang University Hospital in Korea for the period of December 2011 to May 2014. Patients were divided into ≥80 and <80 years of age and clinical characteristics and outcomes were compared among these patients.

Results: A total of 468 patients were evaluated and 102 patients (21.7%) were ≥80 years of age. Overall mortality was 38.5% in the ICU and 44.7% in the hospital. There was no significant difference in ICU and in-hospital mortality rates between those ≥80 years and those <80 years (34.9% vs. 39.5% for ICU mortality, 40.6% vs. 45.9% for in-hospital mortality). In addition, early (<48 h) ICU mortality was not significantly different between patients ≥80 years and patients <80 years (39.4% vs. 53.9%). Lengths of ICU and hospital stays were significantly longer in patients <80 years compared to patients ≥80 years (10.57 ± 19.96 days vs. 8.19 ± 8.78 days for ICU stay; 27.95 ± 39.62 vs. 18.17 ± 15.44 days for hospital stay). The rate of withholding intensive care was significantly higher in patients ≥80 years compared to patients <80 years (22.9% vs. 11.8%).

Conclusions: Clinical outcomes were not significantly different for very elderly critically ill patients compared to those of their younger counterparts in the medical ICU in this study.

Keywords: Elderly, Outcomes, ICU
GENDER DIFFERENCE IN PREOPERATIVE DIASTOLIC FUNCTION IN GERIATRIC PATIENTS FOR NONCARDIAC SURGERY

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Background/Purpose: Women are more likely to occur diastolic heart failure with normal ejection fraction than men. Little has been known so far on diastolic dysfunction and preoperative evaluation for elderly patients in Korea. We studied gender-based differences in the prevalence of preoperative diastolic function in elderly patients for noncardiac surgery.

Methods: Overall, 295 patients who were older than 65 years and scheduled for elective noncardiac surgery were enrolled. The medical records of 178 women and 117 men were reviewed to investigate their preoperative transthoracic echocardiographic data (EF, ejection fraction; DT, deceleration time; E, peak mitral inflow velocity during early filling; A, late filling from atrial contraction; E'/E', mitral annulus early diastolic velocity ratio) and comorbidity.

Results: Women were more obese but less likely to have diabetes mellitus and history of cerebrovascular accident (Table 1, 3) than men. Only 2.8% of women and 5.1% of men had normal diastolic filling pattern. The majority of the patients had relaxation abnormalities with preserved ejection fraction (Table 1, 2). Women had lower E/A ratio and higher E/E' (P<0.05) while DT and EF were similar (Table 1). The incidence of E/E'> 15 was higher in women (16.9%) than in men (3.4%) (P<0.05).

Conclusions: We observed that women scheduled for elective noncardiac surgery had more incidence of elevated left ventricular end-diastolic pressure than men. However, there is a need for more studies.

Key words: Diastolic function, Gender, Geriatric, Preoperative

<table>
<thead>
<tr>
<th>Table 1. Patients’ characteristics</th>
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<td>Age (years)</td>
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<td>BMI (kg/m²)</td>
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<td>EF (%)</td>
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<td>DT (ms)</td>
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<td>E/A</td>
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<td>E'/E'</td>
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Data are mean ± SD. EF, ejection fraction; DT, deceleration time; E, peak mitral inflow velocity during early filling; A, late filling from atrial contraction; E', mitral annulus early diastolic velocity *P<0.05

<table>
<thead>
<tr>
<th>Table 2. Diastolic function</th>
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<td></td>
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<tr>
<td>Normal filling pattern</td>
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<td>Relaxation abnormality</td>
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<td>Pseudonormal pattern</td>
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</table>

Data are count (%).
CLINICAL CHARACTERISTICS OF PATIENTS AGED OVER 90 IN MEDICAL ICU CARE IN KOREA

Junghyun Kim, Sun Mi Choi, Young Sik Park, Chang-hoon Lee, Sang-min Lee, Jae-joon Yim, Chul-gyu Yoo, Young Whan Kim, Sung Koo Han, Jinwoo Lee

Seoul National University Hospital, Republic of Korea

Background/Purpose: The number of elderly patients admitted to the ICU is growing, along with the increasing proportion of the elderly. However, determining characteristics of elderly, especially over nineties whose decision of ICU care is difficult, to provide appropriate care remains a challenge.

Methods: Elderly patients over 90 year-old who got MICU admission between January 2012 and December 2014 were retrospectively reviewed in a tertiary referral hospital in Korea.

Results: Among the 2,186 referred patients, 26 were admitted to MICU aged over ninety from 2012 to 2014. About 61.5% of the patients were female and the mean age was 92.2 years. The median score for Charlson comorbidity index was 2 (IQR 1-3) and the mean SOFA score at day 1 was 7.3 (SD 1.5). The most common reason for MICU care was an acute respiratory failure. About 26.9% of patients were deceased during ICU care and about a half of them were discharged to other hospital (11 pts). Of 11 patients whose DNR orders were taken, none of them were performed before ICU admission. Three-quarters of DNR decision of elderly patients were conducted by their offspring and the mean of these participants in decision making was 1.6 (SD 0.5).

Conclusions: This study showed that in very elderly over 90 year-old patients use MICU for acute respiratory failure most commonly with relatively low comorbidity index scores. We suggest the discussion of end of life care of these very elderly patients be made before they meet critical care when they cannot make their own decisions of life.

Keywords: Elderly patients, Intensive care, Clinical characteristics
CLINICAL OUTCOME OF ELDERLY PATIENTS ADMITTED MEDICAL INTENSIVE CARE UNIT

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ASAN Medical Center, Republic of Korea

Background/Purpose: Many factors are associated with death in intensive care unit (ICU) and age is thought to be one of the major determinant factors. Although elderly patients are increasing in number and thought to exhibit higher incidence of critical illness, data regarding clinical outcome of elderly patients admitted medical ICU are lacking.

Methods: We retrospectively reviewed medical records of patients admitted medical ICU between January 2012 and December 2013. We investigated clinical outcomes of elderly patients defined as 75 years old or more and extreme elderly patients defined as 90 years old or more.

Results: Totally, 2046 patients admitted medical ICU during the period. Among them, 480 patients (23.5%) were elderly and 34 patients (1.7%) were extremely elderly. ICU mortality of overall patients was 24.8%. ICU mortality of elderly patients was 22.5% and showed no significant difference compared with younger patients (p=0.063). ICU mortality of extreme elderly patients was 25.5%, which showed no significant difference (p = 0.537). Additional investigation performed on extreme elderly patients showed median survival to be 110 days (interquartile range: 39 - 361, figure 1).

Conclusions: Age might not be the key factor for deciding ICU care. Further prospective study assessing the clinical outcome of elderly patients is needed.

Keywords: Elderly, ICU, Mortality

<Figure 1>
ARGATROBAN THERAPY FOR HEPARIN-INDUCED THROMBOCYTOPENIA WITH THROMBOSIS

Jae-bum Kim, Jae Hyun Kim, Nam Hee Park
Keimyung University Dongsan Medical Center, Republic of Korea

Background/Purpose: Heparin-induced thrombocytopenia (HIT) is a prothrombotic, immune-mediated adverse reaction caused by immunoglobulin G (IgG) antibodies directed against the heparin-platelet factor 4 complex, leading to platelet activation, excessive thrombin generation, and often thrombosis. HIT with thrombosis (HITT) could develop limb amputation, stroke, and myocardial infarction to death. The current treatment of HIT consists of discontinuing heparin therapy and the administration of an alternative anticoagulant include Danaparoid, Lepirudin, Bivalirudin and Argatroban. We report three cases which successful management of HIT patient with argatroban therapy.

Methods: Three cases we have experience occurred after aortic dissection operation, coronary artery bypass operation and coronary intervention.

Results: First, 5 days after aortic dissection surgery, platelet count was decreased from 210,000/uL to 35,000/uL and the fingers, toes and nose skin color changes occurred. Second, 3 days after coronary artery bypass surgery, platelet count was decreased from 235,000/uL to 32,000/uL and the fingers and toes skin color changes occurred. Third, 6 days after primary coronary intervention, platelet count was decreased from 255,000/uL to 18,000/uL without skin color change. After HIT diagnosis, we start argatroban, adjusted to maintain activated partial thromboplastin times 1.5 to 3 times baseline. Argatroban was continued for up to 14 days, until the underlying condition was resolved or conversion to warfarin therapy occurred. All cases were successfully managed by argatroban therapy.

Conclusions: In HIT management, physician’s experience and judgment are important. We report three cases which successful management of HIT and HITT patient with argatroban therapy.

Keywords: Heparin, Heparin induced thrombocytopenia
IN VIVO AND VITRO HEMOSTATIC EFFECTS OF HES 130/0.4/9 USING SONOCLOT® ANALYSIS

Masafumi Idei¹, Tetsuya Miyashita², Tasuku Yoshida¹, Yuko Matsuda¹, Yoshikazu Yamaguchi¹, Shunsuke Takaki¹, Kenji Mizutani¹, Osamu Yamaguchi¹, Takahisa Goto²

¹Intensive Care Unit, Yokohama City University, Japan; ²Department of Anesthesiology, Yokohama City University, Japan

Background/Purpose: Administration of hydroxyethyl starch (HES) is one of the causes of coagulation abnormalities and platelet dysfunctions since many studies in vitro had been reported. The aim of this study was to investigate the anti-hemostatic effects of low dose of HES in vivo and vitro using Sonoclot SCP2 (Scienco Inc, CO, USA).

Methods: 8 healthy male volunteers were recruited in this study. They were administrated 500 ml of HES 130/0.4/9 (Voluven®, Fresenius Kabi Japan K.K., Tokyo, Japan) for 30 minutes. Hemostatic parameters (Activated coagulation time; ACT, Clot rate; CR, Platelet function; PF, Peak Amplitude; PA and Time to peak; TP) of Sonoclot were measured before and just after the administration of HES. One week after, blood samples of the same volunteers were obtained to measure the same parameters using Sonoclot. 2 ml of the blood samples which were diluted by 0.3 ml of HES were measured simultaneously.

Results: The dilution rates were similar between in vivo and vitro (87.16 +/- 1.75 % and 86.95 %). In vivo study, there were no significant differences in all parameters between HES and control group. In vitro study, there were significant differences in CR (17.4 ± 3.5 vs 20.8 ± 3.8; p = 0.007), PF (1.45 ± 0.76 vs 2.31 ± 1.12; p = 0.002) and PA (77.4 ± 12.6 vs 97.9 ± 12.2; p = 0.017) between HES and control group.

Conclusions: In healthy subjects, although the blood dilution by low dose of HES influences the hemostatic parameters of Sonoclot in vitro, there are little anti-hemostatic differences in vivo.

Keywords: HES, Hemostatic effects, Sonoclot
EVALUATION OF RISK FACTORS FOR MORTALITY IN HEMATOLOGICAL MALIGNANCY PATIENTS ADMITTED TO INTENSIVE CARE UNIT

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¹Erciyes University Faculty of Medicine Internal Medicine Intensive Care Unit, Turkey, ²Erciyes University Faculty of Medicine, Department of Internal Medicine, Turkey

Background/Purpose: Haematological malignancies are associated with treatment related morbidity and mortality. Intensive chemotherapy and haematopoetic stem cell transplantation has increased treatment related complications. Transferring a severely ill patient to the intensive care unit for life support is often a difficult decision. To detects risk factors effecting haematological malignancy patients mortality after admission to the medical intensive care unit.

Methods: This study was performed prospectively in the medical intensive care unit of Erciyes Universtiy Hospital. History, physical exam and laboratory findings on admission, and therapeutic interventions during ICU stay were recorded. The study end point was ICU mortality.

Results: 26 (%56,5) of the 46 patients included into this study were male. The average age of the patients was 48 ± 18 years. The hematological diagnosis of the patients were as follows; 18 were AML, 9 were MM and 6 were ALL. The most common reasons for ICU admissions were respiratory failure (%70) and septic shock (%15). The mean time delay starting from deterioration to ICU was 6 hours (range 1-30). APACHE-2 score was 27 ± 8 and the early warning system score was 10 (range 1-14). APACHE-2 score and time delay for ICU admission of nonsurvivors were higher (p= 0.019, 0.010 respectively). Serum total cortisol levels were lower in survivors compared to nonsurvivors (p= 0,047). ICU mortality rate was 59%.

Conclusions: The mortality rate of haematological malignancy patients was high. The time delay for ICU admission and APACHE-2 score were important risk factors for ICU mortality. These patients should be admitted to the ICU as soon as possible when vital signs are deteriorated.

Keywords: Hematological malignancies, ICU, Mortality, Risk factor
ABSOLUTE EOSINOPHILS COUNT AS A MARKER OF MORTALITY IN PATIENTS ADMITTED TO INTENSIVE CARE UNIT

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Wonkwang University School of Medicine & Hospital, Republic of Korea

Background/Purpose: Inflammatory markers may have a role in predicting severity of illness of intensive care unit (ICU) patients. The reduction in the number of eosinophils may be linked to the action of inflammatory cytokine. The aim of the study was to evaluate the absolute eosinophils count as a marker of mortality in patients admitted to intensive care unit.

Methods: We retrospectively evaluated 28-day mortality and identified risk factors for 28-day mortality in consecutive patients admitted to the ICU. Daily eosinophils count and C-reactive protein (CRP) in all patients was analyzed.

Results: A total of 122 patients were included in the study. The median age was 69.2 years. Overall 28-day mortality was 27.8 % (n = 34). At discharge, the significant differences were found in eosinophils count collected between survivors and non-survivors (260 vs 55, p < 0.05). When the eosinophils counts at discharge was assessed, an area under the curve (AUC) of 0.41 (95 % confidence interval, 0.30 - 0.51 was observed. However, CRP at discharge showed an AUC of 0.78 (95 % confidence interval, 0.69 - 0.86).

Conclusions: Eosinophils count was lower in non-survivors admitted to ICU, but its clinical usefulness seems limited in comparison with CRP.

Keywords: Eosinophils, C-reactive protein, ICU
CONTINUOUS REGIONAL ARTERIAL INFUSION OF PROTEASE INHIBITORS FOR SEVERE ACUTE PANCREATITIS: A PROPENSITY MATCHED ANALYSIS WITH A LARGE RETROSPECTIVE COHORT

Masayasu Horibe¹, Mitsuhiro Sasaki², Hirotaka Sawano³, Takashi Goto⁴, Tsukasa Ikeura⁵, Tsuyoshi Hamada⁶, Takuya Oda⁷, Hideto Yasuda⁸, Eisuke Iwasaki¹, Daisuke Sugiyama¹, Takanori Kanai¹, Toshihiko Mayumi⁹, Masamitsu Sanui¹⁰

¹Keio University School Of Medicine, Japan, ²National Cancer Center, Japan, ³Osaka Saiseikai Senri Hospital, Japan, ⁴Hiroshima City Hiroshima Citizens Hospital, Japan, ⁵Kansai Medical University, Japan, ⁶The University of Tokyo, Japan, ⁷Iizuka Hospital, Japan, ⁸Japanese Red Cross Musashino Hospital, Japan, ⁹University of Occupational and Environmental Health, Japan, ¹⁰Jichi Medical University, Saitama Medical Center, Japan

Background/Purpose: Continuous regional arterial infusion (CRAI) of protease inhibitors has been proposed as a promising modality to reduce the mortality of severe acute pancreatitis. We aimed to assess the effectiveness of CRAI of protease inhibitors in patients with severe acute pancreatitis.

Methods: Patients diagnosed with severe acute pancreatitis at 44 institutions in Japan between June 2009 and December 2013 were enrolled. Patients in CRAI group were matched with those in non-CRAI group by propensity scores calculated for the probability of CRAI. The nearest neighbor approach was used within a caliper <0.25 for a 1-to-1 match. Mortality, infection rate, and intervention requirements were evaluated as outcomes.

Results: Of the 1159 study patients, 1097 patients were eligible for propensity matching analysis, which generated 284 pairs from 374 patients in CRAI group and from 723 patients in non-CRAI group, respectively. The estimated odds ratio after the matching was 0.94 [95%CI (0.59-1.51)] for mortality (p=0.81), 0.92 [95%CI (0.58-1.46)] for infection rate (p=0.72), and 0.75 [95%CI (0.50-1.14)] for intervention requirements (p=0.18).

Conclusions: In our propensity matched analysis, CRAI was not associated with better outcomes including mortality, infection rate and intervention requirements. However, promising data from a meta analysis (Yong FJ et al Hepatobiliary & pancreatic diseases international: 2015;14:10-7) besides our study results may justify a future randomized controlled trial.

Keywords: Severe acute pancreatitis, Continuous regional arterial infusion, Protease inhibitor
COMPARISON OF THE MORTALITY RATE WITH THE KIND OF INVASIVE TREATMENT FOR INFECTED ACUTE NECROTIC COLLECTION (ANC) OR WALLED-OFF NECROSIS (WON): MULTIPLE CENTERS RETROSPECTIVE STUDY

Kazuhiro Minami¹, Masayasu Horibe¹, Mitsuhito Sasaki², Hirotaka Sawano³, Takashi Goto⁴, Tsukasa Ikeura⁵, Tsuyoshi Hamada⁶, Takuya Oda⁷, Hideto Yasuda⁸, Juntaro Matsuzaki¹, Eisuke Iwasaki¹, Takanori Kanai¹, Toshihiko Mayumi⁹, Masamitsu Sanui¹⁰

¹School Of Medicine, Keio University, Japan, ²National Cancer Center, Japan, ³Osaka Saiseikai Senri Hospital, Japan, ⁴Hiroshima City Hiroshima Citizens Hospital, Japan, ⁵Kansai Medical University, Japan, ⁶The University of Tokyo, Japan, ⁷Iizuka Hospital, Japan, ⁸Japanese Red Cross Musashino Hospital, Japan, ⁹University of Occupational and Environmental Health, Japan, ¹⁰Jichi Medical University, Saitama Medical Center, Japan

Background/Purpose: When the patients who are diagnosed severe acute pancreatitis coexisted with infected ANC and WON, the mortality rate is very high. We examined whether it was different in the mortality rate depending on the kind of invasive treatment for infected ANC or WON.

Methods: This retrospective multi-center study was performed at 44 institutions in Japan. All 18 years old or older patients diagnosed with severe acute pancreatitis for 5 years (2009-2013) were enrolled. We selected the patients who were performed invasive treatment for infected ANC and WON, and compared the age, sex, prognostic factor and the mortality rate by each invasive treatment.

Results: Of the 1159 patients with severe acute pancreatitis, 122 patients who coexisted with infected ANC or WON were performed invasive treatment. Thirty three patients were performed open abdominal surgery, 3 patients were performed laparoscopic drainage, 37 patients were performed endoscopic drainage and 49 patients were performed percutaneous drainage. There no significant difference between the mortality rate and the kind of invasive treatment by univariate analysis. (p=0.12) Although both age (p<0.05) and prognostic factor (p<0.05) had significant difference with mortality rate by multivariate analysis, neither sex (p=0.48) and the kind of invasive treatments (p=0.52) did not have significant difference.

Conclusions: There is no significant difference between the mortality rate and the kind of invasive treatment for infected ANC or WON. It may sufficient to choose the method that is easy to approach by location.

Keywords: Severe acute pancreatitis, Acute necrotic collection, Walled-off necrosis

<table>
<thead>
<tr>
<th>The kind of invasive treatment</th>
<th>Age</th>
<th>Men</th>
<th>Prognostic factor</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal operation (n=33)</td>
<td>63 ± 13</td>
<td>24 (72.7%)</td>
<td>8.5 ± 2.3</td>
<td>16 (48.5%)</td>
</tr>
<tr>
<td>Laparoscopic drainage(n=3)</td>
<td>53 ± 13</td>
<td>3 (100%)</td>
<td>6.3 ± 0.6</td>
<td>2 (66.7%)</td>
</tr>
<tr>
<td>Endoscopic drainage(n=37)</td>
<td>58 ± 16</td>
<td>27 (73.0%)</td>
<td>4.4 ± 2.2</td>
<td>10 (27.0%)</td>
</tr>
<tr>
<td>Transdermal drainage(n=49)</td>
<td>65 ± 14</td>
<td>31 (63.2%)</td>
<td>3.9 ± 2.0</td>
<td>14 (28.6%)</td>
</tr>
</tbody>
</table>

<Table 1>
WHO WILL NEED SURGICAL INTERVENTION IN PATIENTS WITH POSTOPERATIVE INTESTINAL OBSTRUCTION? DELTA NEUTROPHIL INDEX AS AN EARLY PREDICTIVE MARKER

Im-kyung Kim, Man Ki Ju

Gangnam Severance Hospital, Republic of Korea

Background/Purpose: Among patients with postoperative intestinal obstruction, it is difficult to predict failure of conservative management. In this study, we evaluate the impact of Delta neutrophil index (DNI) as an early predictor to determine operation in patients with postoperative intestinal obstruction.

Methods: A total of 171 patients who were diagnosed as postoperative intestinal obstruction were enrolled in this study. Initial level of C-reactive protein (CRP), white blood cell count (WBC) and DNI were reviewed. To clarify optimal cutoff values for DNI according to the risk of predicting operation, receiving-operator characteristic (ROC) curves were generated.

Results: Among the 171 patients, 38 patients (22.2%) finally needed surgical intervention. In ROC curves, each area under the curve (AUC) of initial CRP, WBC and DNI was 0.460, 0.449 and 0.543. The optimal cutoff value for predicting further surgical intervention according to initial level of DNI was 4.3 %. The accuracy of the cutoff value was 74.9% with 23.7% of sensitivity and 89.5% of specificity (Positive predictive value = 23.7%, Negative predictive value = 89.5%).

Conclusions: Initial level of DNI as well as CRP or WBC is not a good predictive marker for determining surgical intervention with low sensitivity and specificity in patients with postoperative intestinal obstruction.

Keywords: Postoperative intestinal obstruction, Delta neutrophil index, Predictive marker
VARIOUS CLINICAL PRESENTATIONS OF MESENTERIC TORSION: WHEN TO OPERATE AND WHEN TO NOT?

Young Sun Yoo, Seong Pyo Mun
Chosun University College of Medicine, Republic of Korea

Background/Purpose: In adult patients, the mesenteric torsion is only rarely seen and may be caused by various clinical conditions. The purpose of this study is to investigate the various clinical manifestations and outcomes of patients with mesenteric torsion.

Methods: We retrospectively reviewed the medical records of 24 patients who diagnosed with mesenteric torsion in CT scan. CT findings of ‘whirl sign’ and inversion of the superior mesenteric artery and superior mesenteric vein were diagnosed as mesenteric torsion. Data was collected in terms of underlying causes, bowel ischemia, operation, and outcomes.

Results: Eighteen patients (75%) were male. Previous operation (29.2%), internal hernia (16.7%), mesenteric mass (8.3%), and mesenteric lymph nodes (8.3%) were suggestive causes of mesenteric torsion. Eleven patients (45.8%) were improved with conservative treatment. Small bowel segmental resection (29.2%), hernia reduction and mesentery repair (12.5%), and other operations were performed according to their underlying conditions. Four patients (16.7%) with primary mesenteric torsion of unknown causes were improved after conservative treatment without operation. Small bowel ischemia was in five patients (20.8%) and one patient (4.2%) died due to small bowel perforation and subsequent sepsis.

Conclusions: Clinical presentation of mesenteric torsion is non-specific and associated with various underlying causes. Correct diagnosis by radiologic evaluation and timely appropriate treatment is necessary to prevent potential fatal outcomes.

Keywords: Mesentery, Torsion
EARLY PLASMAPHERESIS IN PATIENTS WITH SEVERE HYPERTRIGLYCERIDEMIA INDUCED ACUTE PANCREATITIS

Deven Juneja, Prashant Nasa, Sudish Sehra, H K Singh, Deepak Gupta, Kumar Nishant, Shashank Shekar

Sr. Consultant and Head, Dept. of Critical Care and Emergency Medicine, India

Background/Purpose: Hypertriglyceridemia can cause severe acute pancreatitis. Main pharmacotherapy for hypertriglyceridemia include insulin, heparin, omega-3 fatty acids, fibrates, statins, or niacin; however, their slow mode of action is a concern in potentially life threatening situation. Plasmapheresis may be used as a therapeutic option in such emergency conditions.

Methods: We report 2 cases of severe acute pancreatitis with severe hypertriglyceridemia where we used early plasmapheresis with improved outcome.

Results: Case 1: 34 year obese female with diabetes mellitus, with SAP was admitted in ICU, with APACHE II score of 14, started on fluid resuscitation and other supportive management. Her ABG showed severe anion gap metabolic acidosis. Blood was highly lipemic and on ultracentrifuge showed triglycerides 9230 mg/dL. She was managed as SHTG induced SAP and diabetic ketoacidosis with enteral fenofibrate other supportive management. Her condition further deteriorated next day with increasing respiratory distress, increased requirement of vasopressors and she was started on plasmapheresis. Her triglycerides after plasmapheresis decreased to 1620mg/dL and 435 mg/dl after 1st and 2nd session respectively. There was improvement in her clinical condition including respiratory failure. Case 2: 35 year old obese male admitted with SAP. His blood was lipemic and after ultracentrifuge showed triglycerides 6241 mg/dl. He was taken for urgent plasmapheresis on day 2 in view of deteriorating clinical condition. Post plasmapheresis, his triglycerides decreased to 445 mg/dl and patient showed significant improvement with resolution acidosis and respiratory distress.

Conclusions: Plasmapheresis is an effective therapeutic option for SHTG induced SAP with rapid reduction of serum triglycerides and can be considered early in management.

Keywords: Plasmapheresis, Severe hypertriglyceridemia, Severe acute pancreatitis, Case report

Table 1: Initial laboratory investigations

<table>
<thead>
<tr>
<th>Laboratory Investigation</th>
<th>Case 1</th>
<th>Case 2</th>
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<tbody>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>14.1</td>
<td>15.0</td>
</tr>
<tr>
<td>Total leucocyte count (x10⁹/L)</td>
<td>14.5</td>
<td>13.2</td>
</tr>
<tr>
<td>CRP (mg%)</td>
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<tr>
<td>Serum Amylase (U/L)</td>
<td>1124</td>
<td>774</td>
</tr>
<tr>
<td>Serum lipase (U/L)</td>
<td>705</td>
<td>640</td>
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<tr>
<td>Serum triglycerides (mg/dL)</td>
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<td>6241</td>
</tr>
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<td>Serum Cholesterol (mg/dL)</td>
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</tr>
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<td>Serum Calcium/creatinine/phosphorus/mg/L</td>
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<td>Glucose (mg%)</td>
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<tr>
<td>LDH (IU/L)</td>
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THE CLINICAL EFFECT OF MICROWAVE AND ULTRASHORT WAVE THERAPY FOR TREATMENT OF GASTROINTESTINAL DYSFUNCTION IN PATIENTS WITH SEPSIS

Cao Li Jun, Sun Yun, Tang Yan, Lu Zhong Hua

Cao Iijun, China

Background/Purpose: To explore the effect of Microwave and Ultrashort wave therapy for treatment of gastrointestinal dysfunction in patients with sepsis.

Methods: A prospective, randomized controlled trial was conducted in eighty patients with sepsis that were admitted in intensive care unit (ICU) in the second Hospital of Anhui Medical University. These patients were divided into Microwave and Ultrashort wave therapy group (MM) and conventional therapy group using a random number table method, and each group had 40 patients. Conventional therapy was only used in conventional therapy group, and Microwave and Ultrashort wave treatment on the base of conventional therapy was applied in MM group (once a day, for 10 days, 15 minutes each time). The incidence of the intra-abdominal pressure (IAP) and gastrointestinal dysfunction were compared between the two groups before treatment and on the 3rd, 7th and 10th day after treatment.

Results: There was no statistical significance in IAP between the two groups before treatment (P > 0.05), but the IAP scores decreased gradually with the prolongation of therapeutic time. The IAP scores of both groups were lower than those before treatment. The IAP scores reached the valley value on the 10th day and the changes in MM group were more remarkable [IAP: 7.1±5.4 vs. 15.8±6.9, P < 0.05]. In the MM group, the incidences of the untoward symptoms and signs of gastrointestinal dysfunction such as bleeding of stress ulcer, toxic intestinal paralysis, abdominal distension, diarrhea and so on were lower than those in conventional therapy group [stress ulcer bleeding: 15.0% (6/40) vs. 40.0% (16/40), toxic intestinal paralysis: 17.5% (7/40) vs. 42.5% (17/40), abdominal distension: 20.0% (8/40) vs. 42.5% (17/40), diarrhea: 7.5% (3/40) vs. 17.5% (14/40) all P < 0.05].

Conclusions: Microwave and Ultrashort wave therapy can effectively reduce the incidence of gastrointestinal dysfunction in treatment of patients with sepsis.

Keywords: Microwave and ultrashort wave therapy, Sepsis, Gastrointestinal dysfunction
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THE USEFULNESS OF LUNG ULTRASOUND IN DIFFERENTIAL DIAGNOSIS FOR BILATERAL DIFFUSE INFILTRATION ON CHEST X-RAY

Jin Jeon, Sang-Bum Hong, Chae-man Lim, Younsuck Koh, Jinwon Huh

ASAN Medical Center, Republic of Korea

Background/Purpose: Bedside chest radiography is routinely used to assess the respiratory condition of critically ill patients. Many patients have bilateral diffuse infiltration on chest radiography in the intensive care unit (ICU). Differential diagnosis between acute cardiogenic pulmonary edema or pneumonia may often be difficult on chest radiography. It is important to differentiate pulmonary edema from bilateral pneumonia. We evaluated the ability of lung ultrasound by differential diagnosis.

Methods: This prospective observational study was performed for the patients (over 18 years old) with bilateral diffuse infiltration on chest X-ray in the ICU during 10 months. At first, we checked the presence of: 1) alveolar-interstitial syndrome (AIS) 2) pleural lines abnormalities 3) absence or reduction of gliding sign 4) spared areas 5) consolidations 6) pleural effusion 7) lung pulse using 2-6MHz curved probe. Then we checked heart to detect 3Es: Effusion (cardiac tamponade), Equality (Right vent ricular enlargement), Ejection fraction on parasternal long axis and apical or subcostal four chamber view using 2-4 MHz probe. We divided all the possible conditions into 3 categories (pulmonary edema, pneumonia/ARDS, mixed). We compared it with clinical diagnosis, post- ultrasound diagnosis, final diagnosis which was categorized with the same method and examined the agreements using kappa statistics.

Results: 38 patients were finally enrolled. Cohens kappa between clinical diagnosis and post-ultrasound diagnosis was 0.437(p<0.000), between post-ultrasound diagnosis and final diagnosis was 0.672 (p< 0.000).

Conclusions: Lung ultrasound can be helpful in differential diagnosis for bilateral diffuse infiltration on chest radiography in the ICU.

Keywords: Lung ultrasound

<table>
<thead>
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<th>Table 1 Clinical diagnosis vs post-ultrasound diagnosis crosstable</th>
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<tr>
<td>Clinical diagnosis</td>
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<tr>
<td>Pneumonia/ARDS</td>
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<td>Pulmonary edema</td>
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<th>Table 2 Post-ultrasound diagnosis vs final diagnosis crosstable</th>
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<td>Post-ultrasound diagnosis</td>
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<tr>
<td>Pneumonia/ARDS</td>
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<td>Pulmonary edema</td>
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<tr>
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PROGNOSTIC ROLE OF CIRCULATING MITOCHONDRIAL DNA IN KOREAN PATIENTS ADMITTED TO THE ICU

Jeong Hoon Yang, Jeong-am Ryu, Dae-sang Lee, Jinkyeong Park, Chi Ryang Chung, Kyeongman Jeon, Chi-min Park, Seonmin Lee, Yeonghui Kim, June Seon Park, Gee Young Suh, Augustine M. K. Choi

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Mitochondrial DNA (mtDNA) is an activator of inflammation and the innate immune system. Increased mitochondrial DNA (mtDNA) levels are associated with ICU mortality in Western population. However, no data is available on the association of admission mtDNA level with in-hospital mortality in Asians admitted to the ICU.

Methods: Between April 2014 and January 2015, analyses of mtDNA levels were performed on blood samples obtained from a prospective observational cohort studies of ICU patients. mtDNA levels in plasma were assessed by measuring the copy number of the NADH dehydrogenase 1 gene using quantitative real-time PCR. Primary outcome was in-hospital mortality.

Results: Among 118 patients with a median age of 61 (IQR 50-69) years, 97 patients (82.2%) lived to be discharged from the hospital. A sepsis (n=58) was the most common cause of ICU admission, followed by ST-elevation myocardial infarction (n=33). Patients with sepsis had a higher level of mtDNA level compared with the non-sepsis group (2016 [760-5130] versus 602 [342-1945] copies/ml plasma, p<0.001). There was no significant difference of in-hospital mortality between an elevated mtDNA group (≥1,243 copies/ml plasma) and the other group (p=0.81). In-hospital mortality was predicted by SAPS III score with a c-statistic of 0.751 (95% confidence interval [CI], 0.663-0.826, p<0.001), SOFA score with a c-statistic of 0.778 (95% CI, 0.691-0.850, p<0.001), and mtDNA level with a c-statistic of 0.529 (95% CI, 0.435-0.621, p=0.67).

Conclusions: mtDNA level in septic patients was significantly higher than those in non-septic patients. However, mtDNA level could not predict in-hospital mortality in Korean patients admitted to the ICU.

Keywords: mtDNA, ICU, Sepsis
CLINICAL CHARACTERISTICS AND RISK FACTORS FOR MORTALITY IN CRITICALLY ILL SURGICAL PATIENTS WITH ACINETOBACTER BAUMANNII PNEUMONIA

Ji Young Jang, Hongjin Shim, Pil Young Jung, Seongyup Kim, Keum Seok Bae

Yonsei University Wonju College of Medicine, Republic of Korea

Background/Purpose: The aim of this study was to evaluate the characteristics of critically ill surgical patients with Acinetobacter baumannii (AB) pneumonia and to determine risk factors for mortality in these patients.

Methods: The electronic medical records of 104 critically ill surgical patients diagnosed as pneumonia from April 2011 to October 2014 were analyzed retrospectively. Clinical characteristics, variables associated with patients' conditions at time of bacterial culture, microbiologic results and clinical outcomes were evaluated.

Results: Mean patient age was 59.9 years, and mean ASA score was 3.7. Forty-five patients (43.3%) were admitted due to trauma, and 44 patients (41.9%) underwent a non-traumatic emergency operation. When cultures were performed, 68 patients (65.4%) were supported by mechanical ventilation (MV), and 17 had acute renal failure. Multi-drug resistant (MDR) AB and carbapenem-resistant (CR) AB were isolated from 89 (85.6%) and 95 patients (91.3%) respectively. Mean length of ICU stay was 26.9 days, and median duration of MV was 12 days. Univariate analysis indicated age, occurrence of shock at time of bacterial culture, acute renal failure, responsiveness to treatment, and carbapenem use before AB isolation were associated with in-hospital mortality. Multivariate analysis showed that responsiveness to treatment and the use of carbapenem before AB isolation were independent risk factors of mortality.

Conclusions: More intensive management and alert monitoring are needed for surgical patients with AB pneumonia and the above-mentioned independent risk factor to prevent poor prognosis.

Keywords: Acinetobacter baumannii, Pneumonia, Risk factor, Mechanical ventilation
IMPACT OF CHLORHEXIDINE DRESSING IN CATHETER RELATED BLOODSTREAM INFECTION IN CRITICAL ILL PATIENTS

Graciela Beatriz Cueto, Jorge Raul Rodriguez, Margarita Adriana Torres Boden, Carlos Bruno Cozzani, Maria Enriqueta Branas, Marcela Badia, Laura Lopez Moral, Wanda Cornistein

Intensive Care, Hospital C Argerich, Argentina

Background/Purpose: Testing the chlorhexidine impregnated dressing effect on lowering catheter related bloodstream infection (CRBSI) rates against standard film and reinforce bordered dressing types, for catheter insertion site in critical ill patients.

Methods: Prospective, randomized controlled clinical trial, in patients with central venous catheters (CVC) placed for more than 48 hours in the ICU, from July 2012 to July 2013. Patients were randomly assigned to three groups: the control group with standard film dressing protection, a second group with reinforces bordered dressing and a third group with chlorhexidine impregnated gel pad with reinforce bordered dressing. All types of dressing were transparent allowing the monitoring of that catheter insertion site. The anatomical locations for catheter insertion were only at jugular and subclavian veins. The study protocol was implemented in two intensive care units of 20 beds each, part of the Intensive Care Division at Buenos Aires Government Public Hospital with 400 beds.

Results: The overall CRBSI rate was 5.10%. The control group (48 patients) had a CRBSI rate of 7.39%, reinforce bordered film dressing group (46 patients) had a CRBSI rate of 5.32% and the CHG gel pad with reinforce bordered dressing group (46 patients) had a CRBSI rate of 2.6%. The reduction in CRBSI rate seen with the CHG dressing was 51% compared to reinforce bordered dressing and 64.8% compared to standard film dressing.

Conclusions: The transparent film dressing with chlorhexidine impregnated gel pad appears to be an adequate option for lowering the CRBSI rate in critical ill patients.

Keywords: Central venous catheter, Catheter related bloodstream infection
SEVERE NOSOCOMIAL INFECTIONS AND RESISTANCE PATTERNS IN A INTENSIVE CARE OF EDGARDO REBAGLIATI MARTINS NATIONAL HOSPITAL. LIMA - PERU

Juan Carlos Alva Pinto, Marlene Belleza, Rocio Jimenez
Hospital Nacional Edgardo Rebagliati Martins, Peru

Background/Purpose: Severe nosocomial infections are a main problem in patients from intensive care units (ICU). These contribute to increased morbidity, mortality and costs. Problem of severe infections has worsened because germs are becoming increasingly resistant to antibiotics and development of new antibiotics is declining. Purpose of this paper is identifying what kind of infections, germs and resistance patterns are found in ICU.

Methods: This is a descriptive study. All culture-positive cases were included for the period from 2011-14. A severe nosocomial infection was defined as a culture-positive case originated in ICU, sepsis criteria and organ or system failure. The culture-positive cases without evidence of sepsis were considered colonization.

Results: In 2011-14 period were reported 601 positive cultures. 498 (82.86%) were infections and 103 colonizations. From infections, 266 (53.41%) were nosocomial infections. About kind of infections, the main observed were: Pneumonia (48.49%), Bacteremia (24.06%), Urinary infection (18.04%) and Surgical wound infection (5.26%). About kind of germ, the main observed were: Pseudomona aeruginosa (25.18%), Acinetobacter baumannii (20.67%), Candida albicans and non albicans (14.28%), Stenotrophomona mantofilia (9.02%) and Stafilococcus aureus (6.01%). About antibiotic resistance, more frequent resistance founded was to: Piperacilin/Tazobactam (8.28%), Ceftazidime (7.64%), Levofoxacin (7.0%), Cefepime (6.68%), Ciprofoxacin (6.61%), Meropenem (6.36%) and Ticarcilin/Clavulanic (6.36%).

Conclusions: Analysis of infection and germ types is useful for the implementation of disease control policies that prevent transmission of germs. Analysis of resistance patterns allows the implementation of an institutional antibiotic stewardship program, and provides insights about how the genome that confer resistance are transmitted between different species of bacteria.

Keywords: Severe infections, Critical care infections, Resistance
THE CLINICAL EFFECTIVENESS AND SAFETY OF CHLORHEXIDINE BATHING IN CRITICALLY ILL PATIENTS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

Eun Young Choi
Yeungnam University College of Medicine, Republic of Korea

Background/Purpose: Whole-body skin decolonization with chlorhexidine in critically ill patients reduces multi-drug resistant bacterial colonization, and catheter-related bloodstream infection (BSI). We performed a meta-analysis of randomized controlled trials to determine if daily bathing with chlorhexidine decreased hospital-acquired BSIs in critically ill patients.

Methods: We searched the MEDLINE, EMBASE, and Cochrane Central Register of Controlled Trials databases to identify randomized controlled trials that compared daily bathing with chlorhexidine and a control in critically ill patients. The primary outcome was hospital-acquired BSIs. Secondary outcomes were adverse effects of chlorhexidine and the incidence of identified pathogens.

Results: This meta-analysis included five studies. The overall incidence of measured hospital-acquired BSIs was significantly lower in the chlorhexidine group compared to the controls 0.82 (95% CI, 0.73 - 0.91; P < 0.001; I² = 20.6%). Gram-positive induced (RR = 0.59, 95% CI, 0.44 - 0.79, P = 0.000; I² = 46.0%) bacteremias were significantly less common in the chlorhexidine group. The incidence of MRSA bacteremias (pooled RR 0.60; 95%CI, 0.43 - 0.85, P = 0.006; I² = 8.0%) was significantly lower among patients who received mupirocin in addition to chlorhexidine bathing than among those who were not routinely received with mupirocin. The overall incidence of adverse events was similar in both groups.

Conclusions: Daily bathing with chlorhexidine was associated with reductions in the rates of measured hospital-acquired BSI without significant complications in critically ill patients. Daily bathing with chlorhexidine decreased the incidence of Gram-positive bacteremia. However, the use of chlorhexidine bathing alone may have a limited role in the reduction of MRSA bacteremia without the addition of intranasal mupirocin.

Keywords: Chlorhexidine, Mupirocin, MRSA, Critically ill
CLINICAL USEFULNESS OF PROCALCITONIN AND C-REACTIVE PROTEIN AS OUTCOME PREDICTORS IN CRITICALLY ILL PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK

Jeong-am Ryu, Jeong Hoon Yang, Daesang Lee, Chi-min Park, Gee Young Suh, Kyeongman Jeon, Joongbum Cho, Chi Ryang Chung

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Sepsis is a major cause of mortality and morbidity in critically ill patients. Procalcitonin (PCT) and C-reactive protein (CRP) are the most frequently used biomarkers in sepsis. We investigated changes in PCT and CRP concentrations in critically ill patients with sepsis to determine which biochemical marker better predicts outcome.

Methods: We retrospectively analyzed 171 episodes in 158 patients with severe sepsis and septic shock who were admitted to the Samsung Medical Center intensive care unit from March 2013 to February 2014. The primary endpoint was patient outcome within 7 days from ICU admission (treatment failure) and 28-day mortality.

Results: Severe sepsis was observed in 42 patients (25%) and septic shock in 129 patients (75%). Fifty-five patients (32%) had clinically-documented infection and 116 patients (68%) had microbiologically-documented infection. Initial peak PCT and CRP levels were not associated with treatment failure and 28-day mortality. However, PCT clearance (PCTc) and CRP (CRPc) clearance were associated with treatment failure (p = 0.007 and p < 0.001, respectively) and 28-day mortality (p = 0.005 and p = 0.004, respectively). The AUC for prediction of treatment success was 0.65 (95% CI, 0.55 - 0.74) for PCTc and 0.69 (95% CI, 0.60 - 0.78) for CRPc. The AUC for survival prediction was 0.67 (95% CI, 0.57 - 0.76) for PCTc and 0.66 (95% CI, 0.58 - 0.73) for CRPc.

Conclusions: Changes in PCT and CRP concentrations were associated with outcomes of critically ill septic patients. CRP may not be inferior to PCT in predicting outcome in these patients.

Keywords: Sepsis, Procalcitonin, C-reactive protein, Intensive care unit
AN EX VIVO PRELIMINARY STUDY OF NOVEL BLOOD PURIFICATION FOR MODULATING EXCESSIVE IMMUNE REACTIONS IN SEPSIS

Yoshitaka Hara\textsuperscript{1}, Yasuyo Shimomura\textsuperscript{1}, Tomoyuki Nakamura\textsuperscript{1}, Naohide Kuriyama\textsuperscript{1}, Chizuru Yamashita\textsuperscript{1}, Mika Suga\textsuperscript{1}, Yu Kato\textsuperscript{1}, Taku Miyasho\textsuperscript{2}, Toshikazu Sakai\textsuperscript{1}, Shingo Yamada\textsuperscript{3}, Kazuhiro Moriyama\textsuperscript{1}, Osamu Nishida\textsuperscript{1}

\textsuperscript{1}Department of Anesthesiology and Critical Care Medicine, Fujita Health University School of Medicine, Japan, \textsuperscript{2}Department of Veterinary Science school of Veterinary Medicine, Rakuno Gakuen University School of Veterinary Medicine, Japan, \textsuperscript{3}Shino-Test Corporation, Japan

Background/Purpose: It has been reported that blood purification regulating mediators was useful for septic patients, however, the immunological mechanisms remain unclear. We have been developing a new blood purification system for regulating excessive immune reactions in severe sepsis and septic shock using a granulocyte adsorbing column (Adacolumn (Ada)), and a cytokine-adsorbing hemofilter (AN69ST hemofilter (AN69)).

Methods: Fresh porcine blood was circulated for six hours in five experimental groups: the combination of Ada or not (Blank: an empty column not filled with beads) and AN69 or not (FX: a polysulfone membrane with no mediator-adsorbing ability) with LPS: 1) Blank+FX, 2) Blank+AN69, 3) Ada+FX, and 4) Ada+AN69; and 5) Blank+FX without LPS (control group). We evaluated the effects of leukocyte adsorption, phagocytic activity and adhesiveness of granulocytes.

Results: Ada mainly adsorbed granulocytes and monocytes, but not lymphocytes. The phagocytic activity level of granulocytes decreased, and adhesiveness increased, but the number of CD11b-positive cells markedly decreased in the system. Elevated cytokine levels (IL-1\textbeta, IL-8 and IL-10) at the outlet of Ada were significantly lower than at the outlet of AN69 due to cytokine adsorption.

Conclusions: Ada continuously removed granulocytes from LPS-stimulated fresh porcine blood. The overall phagocytic activity and adhesiveness of granulocytes were reduced by the system, and the AN69ST membrane removed not only inflammatory, but also anti-inflammatory cytokines, such as IL-10. These results suggest the usefulness of this system for immunomodulation.

Keywords: Sepsis, Blood purification, Immunomodulation
Clinical Medicine - Infections

CLINICAL CHARACTERISTICS AND PROGNOSTIC FACTORS OF CANDIDEMIA IN CRITICALLY ILL PATIENTS

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Background/Purpose: Patients admitted to intensive care unit (ICU) are at high risk of candidemia, which is still one of the leading causes of mortality in critically ill patients, especially in nosocomial setting. The aim of this study was to analyze the clinical characteristics, outcome, and prognostic factors of candidemia in ICU patients.

Methods: This retrospective, multi-center study was conducted at five university-affiliated hospitals in Korea from 2007 to 2013. The characteristics and outcomes of ICU patients were compared to that of non-ICU patients. In addition, factors related to mortality were reviewed for ICU patients.

Results: Of the total 483 candidemia, 183 were developed in ICU patients. Prior use of broad-spectrum antibiotics, candida colonization, mechanical ventilation, and renal replacement therapy within 30 days before the onset of candidemia were more common in ICU patients than in non-ICU patients. Septic shock was more common in ICU patients than in non-ICU patients (41.0% vs. 16.0%, p<0.001). In contrast, antifungal treatment was performed less frequently in ICU patients (53.0% vs. 66.7%, p=0.003). Overall 30-day mortality and candida-related mortality (CRM) were 63.5% vs. 50.0% (p=0.004) and 34.3% vs. 24.8% (p=0.027) in ICU vs. non-ICU patients, respectively. Among ICU patients, septic shock (HR 3.222; 95% CI 1.918 - 5.414, p<0.001) and antifungal treatment (HR 0.295; 95% CI 0.173 - 0.504, p<0.001) were independent factors for CRM.

Conclusions: ICU patients have risk factors for the development of candidemia with higher mortality compared to non-ICU patients. Antifungal treatment was the modifiable prognostic factor of CRM. Concomitant septic shock can predict poor outcome.

Keywords: Candidemia, Critical care, Intensive Care Unit, Septic shock
ISOLATED PATHOGENS FROM 2012 TO 2014 IN NAGOYA UNIVERSITY ICU

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Background/Purpose: The emergency and medical ICU (EMICU) opened in May 2011 as a closed system ICU at Nagoya University in Japan. We built a management bundle for systemic inflammatory response syndrome (SIRS) including infection management as sepsis. This includes complete contact infection prevention and the antibiogram production. The purpose of this study is to investigate the characteristics of pathogens isolated in our EMICU.

Methods: 706 pathogens were isolated from 339 patients who admitted to our ICU for 3 years from January 2012 to December 2014. When the same pathogen was isolated more than twice in the same patient, the first pathogen was evaluated. The minimum inhibitory concentration (MIC) was determined by Clinical and Laboratory Standard Institute (CLSI) recommendation.

Results: Major pathogens were Staphylococcus aureus (110 isolates, 16%), Coagulase negative Staphylococcus (85 isolates, 12%), Enterococcus species (81 isolates, 11%), Klebsiella species (74 isolates, 10%), Escherichia coli (63 isolates, 9%) in descending order. Among Staphylococcus aureus, 36 isolates (33%) were methicillin-resistant Staphylococcus aureus (MRSA). As for extended-spectrum beta lactamase (ESBL) producing bacteria, 13 isolates (21%) were detected among Escherichia coli, 2 isolates (4%) among Klebsiella pneumoniae, which have high sensitivity to carbapenem antibiotics.

Conclusions: We evaluated the pathogen profile in our EMICU to perform appropriate antibiotic usage. As approximately 33% of Staphylococcus aureus was MRSA, the combination therapy of anti-MRSA antibiotics would be applicable when Staphylococcus aureus was detected by Gram staining.

Keywords: Bundle, Emergency and medical ICU, Antibiogram, MRSA, ESBL
CHARACTERISTICS OF PATHOGENS ISOLATED FROM BILE CULTURES IN NAGOYA UNIVERSITY HOSPITAL FROM 2012 TO 2014

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Background/Purpose: Acute cholangitis and cholecystitis are often managed at Emergency and Medical ICU (EMICU). We followed up on the change of frequency and susceptibility profile of pathogens isolated from bile cultures in Nagoya University Hospital.

Methods: We analyzed 1,822 pathogens isolated from bile cultures of 608 patients who admitted in Nagoya University for 3 years from January 2012 to December 2014. When the same pathogen was isolated more than twice from the same patient, we evaluated the first pathogen. Minimum inhibitory concentration (MIC) was determined according to Clinical and Laboratory Standard Institute (CLSI) recommendation.

Results: Major pathogens isolated were Enterococcus faecalis (250 isolates, 14%), Klebsiella pneumoniae (202 isolates, 11%), Enterococcus faecium (162 isolates, 9%), Enterobacter cloacae (130 isolates, 7%), Klebsiella oxytoca (119 isolates, 7%) and so on. As for extended-spectrum beta lactamase (ESBL) -producing bacteria, 13 isolates (12%) were detected among Escherichia coli, 1 isolate (1%) among Klebsiella oxytoca, 4 isolates (2%) among Klebsiella pneumoniae, which have high sensitivity to carbapenem antibiotics.

Conclusions: We concluded that in accordance with the severity of the patients suffering from biliary infection in our EMICU, the use of a combination of anti-MRSA antibiotics and carbapenems should be one of the acceptable options as empiric therapy. The characteristics of pathogens isolated from bile cultures will be followed in Nagoya University Hospital every year to revise our therapeutic strategy for biliary infection in EMICU.

Keywords: Cholangitis, Cholecystitis, Extended-spectrum beta lactamase, Carbapenem, Emergency and Medical ICU
THE HEART-TYPE FATTY ACID-BINDING PROTEIN (H-FABP) ACCURATELY PREDICTS CARDIOVASCULAR EVENTS IN SEVERE SEPTIC PATIENTS

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Background/Purpose: Cardiovascular events (CE) during and after sepsis are frequent and known to increase mortality. The heart-type fatty acid-binding protein (H-FABP) is a sensitive and specific biomarker of myocardial injury. They aim of this study was to determine the relation between H-FABP levels and the incidence of CE in patients with severe septic admitted to the ICU.

Methods: This is a secondary analysis of a randomized control trial of subjects with diagnosis of severe sepsis with ≥1 organ failure. We used ELISA to determine serum H-FABP levels at the time of ICU admission. The primary outcome was incidence of CE determined by the major cardiovascular events (MACE) score. The non-parametric Mann-Whitney U Test was used to test for differences in median (IQR) of H-FABP serum concentrations. A receiver operating characteristic (ROC) curve was developed to assess the accuracy of H-FABP to predict CE.

Results: 51 subjects were included in the study. No statistically significant differences were found in demographics, comorbidities, APACHE score and ICU diagnosis among patients with and without CE during the ICU stay. The median (IQR) serum concentration of H-FABP was greater in patients who developed CE versus patients without CE (5.80 [3.71-9.11] vs. 2.60 [1.09-6.08], p=0.03). Elevated serum levels of H-FABP were identified as a predictor of CE with an area under the curve (AUC) of 0.743 (95% Confidence Interval: 0.62-0.90).

Conclusions: H-FABP is elevated in individuals with adverse cardiovascular events with severe sepsis. Prospective studies are warranted to assess H-FABP in larger cohorts of patients.

Keywords: Sepsis, Cardiovascular events, Intensive care unit
FACTORS ASSOCIATED TO LENGTH-OF-STAY OF PEDIATRIC DENGUE VIRAL INFECTION (DVI) AT WANGAYA HOSPITAL, DENPASAR CITY, BALI PROVINCE

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Background/Purpose: DVI has been recognized as a major public health threat in tropical areas causing 90% deaths of children under 15 years. The incidence of DVI is escalating in the last five years resulted in increasing hospitalization especially for children. Until currently, only limited study has been undertaken to explore the factors associated to length of stay of DVI patients in Indonesia, particularly among children in Bali Province.

Methods: A cross-sectional study with a total sample of 95 children was conducted in Denpasar City. All DVI cases among children from January to December 2014 admitted to Wangaya Hospital were included in this study. Wangaya Hospital has been chosen because it is the referral hospital for all DVI cases in Denpasar City. Data were collected by extracting information from the medical records. Then, data were analyzed using univariate and bivariate analysis (pearson correlation).

Results: A minimum hospital stay of pediatric DVI was one day and the maximum stay was 10 days. The average of hospital stay was 3.89 ± 1.69 days. There is a weak negative association between length of stay and initial platelet count (r=0.26; p=0.01). A positive association between hospital stay and initial hematocrit count (r=0.32; p=0.02) and nausea/vomiting (r=0.2; p=0.048) is documented.

Conclusions: Initial platelet and hematocrit count and the presence of nausea/vomiting are associated to longer hospital stay of pediatric DVI patients. This study suggests that early admission to hospital may reduce the length of stay thus will decrease associated costs.

Keywords: Dengue viral infection (DVI), Length of stay, Hospital stay, Children, Denpasar
ANTIBIOTIC RESISTANCE OF ACINETOBACTER BAUMANNII ISOLATES FROM BLOOD CULTURE IN THE ANESTHESIOLOGY AND REANIMATION INTENSIVE CARE UNIT BETWEEN 2011-2014 YEARS

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Background/Purpose: Acinetobacter baumannii strains in recent years have become an important nosocomial pathogen in intensive care units. Treatment of Acinetobacter infections is difficult because strains are often resistant to antibiotics, including the carbapenems.

Methods: In this study, we aimed to investigate resistance to colistin, imipenem, tigecycline, and cefaperazone-sulbactam among A. baumannii strains isolated from blood samples from the Anesthesiology and Reanimation Intensive Care Unit patients in four years period.

Results: This study was performed in the Eskiehir Osmangazi University Medical Faculty Hospital. Microbiological examinations were carried out in the Clinical Microbiology Department. Bacterial growth was detected by BACTEC 9240 automatized blood culture system. Identification of bacteria and antimicrobial susceptibility testing was performed using Phoenix.

Conclusions: In addition to the intrinsic resistance subsequently acquired resistance shows a dramatic increase especially to carbapenems among Acinetobacter baumannii strains. The lack of colistin resistance in blood isolates was excellent. But rarely colistin resistance is detected in strains isolated from various clinical samples other than blood. This may be a herald of the resistance increase in the future.

Keywords: Acinetobacter baumannii, Intensive care unit, Antibiotic resistance
EFFECTS OF AIRWAY OBSTRUCTION ON DISTRIBUTION OF A CONTROLLED VENTILATION IN ASYMMETRIC LUNG COMPLIANCE MODEL

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Background/Purpose: Unilateral lung hyperinflation occurring in obstructive lung disease with asymmetric lung compliance leads to acute vital instabilities. Unilateral lung hyperinflation is mainly due to dynamic hyperinflation, which can be affected by compliance, tidal volume, airway resistance and respiration rate changes.

Methods: The model was made by using two test lungs, each named lung1 and lung2. To make asymmetric lung compliance, two groups were set by manipulating lung1 compliance as ARDS lung (ARDS group) and COPD lung (COPD group), while fixating lung2 compliance as normal lung. In addition, control group with symmetric compliance of normal lung was set. Respiratory variables were measured above (proximal measurement) and below (distal measurement) the trachea. The model was mechanically ventilated, while airway diameter was changed from 3 to 8 mm serially by 1 mm intervals.

Results: Auto-PEEP had statistically significant increase below ID 5 mm, and also had statistically significant increase throughout airway diameter change in COPD group versus control and ARDS groups. VL1/VL2 was similar to CL1/CL2 in most of the group at distal measurement, but VL1/VL2 approached to value of 1 in distal measurement of COPD group at ID 3 and 4 mm.

Conclusions: Ventilatory distribution was proportionate to lung compliance. Auto-PEEP was statistically increased when airway cross sectional area decreased to 7.1 cm² (ID 3 mm) in ARDS group and 19.6 cm² (ID 5 mm) in control and COPD group. COPD group alone showed statistically significant PEEP. Adequate limitation of flow and inspiratory pause may ameliorate uneven ventilatory distribution.

Keywords: Airway obstruction, Lung compliances, Respiratory
THE PREDICTIVE VALUE OF NT-PROBNP AND TRANSPULMONARY THERMODILUTION MEASUREMENTS FOR WEANING OUTCOMES OF CRITICALLY-ILL PATIENTS WITH MECHANICAL VENTILATION

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Background/Purpose: To evaluate the predictive value of NT-proBNP and transpulmonary thermodilution measurements for weaning outcomes of critically-ill patients who are difficult to wean from mechanical ventilation.

Methods: A prospective study was conducted in adult patients who had been ventilated for more than 24 hours. Each of patients was monitored through a pulse indicator continuous cardiac output (PiCCO) device. Patients who met the criteria of 2001 American weaning guidelines initiated spontaneous breathing trial (SBT) and then extubated if successfully passing SBT. The fluid balance, results of arterial blood gas, serum levels of NT-proBNP, and results of transpulmonary thermodilution measurements were compared between patients with different SBT outcomes and between patients with different weaning outcomes. Afterwards, their predictive values in SBT outcomes and weaning outcomes were evaluated.

Results: A total of 34 patients were enrolled in the study, including 20 (58.8%) men and 14 (41.2%) women, with an average APACHE II score of 21.6 ± 1.4, and their median duration of mechanical ventilation was 67.5 (39, 528) hours. Based on the weaning outcomes, 16 (47.1%) patients successfully weaned from the mechanical ventilation over 48 hours after extubation, while 18 patients (52.9%) failed. Four parameters were significant predictors for the weaning outcomes, including the daily fluid balance before SBT (AUC=0.733±0.090, P=0.021), GEDVI (AUC=0.714±0.088, P=0.034), the extravascular lung water index (EVLWI) (AUC=0.799±0.076, P=0.003), and PVPI (AUC=0.873±0.058, P<0.001)(Image 1).

Conclusions: Compared with NT-proBNP and other traditional volumetric parameters, transpulmonary thermodilution measurements show a significantly higher predictive value for weaning outcomes of patients with mechanical ventilation.

Keywords: Weaning, NT-proBNP, Mechanical ventilation, PiCCO
CLINICAL USEFULNESS OF THE PROVENT SCORE IN KOREAN PATIENTS WITH PROLONGED MECHANICAL VENTILATION

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Background/Purpose: To evaluate clinical usefulness of a prognostic scoring system (the ProVent score) in Korean patients requiring prolonged mechanical ventilation (PMV, ventilator care ≥ 21 days).

Methods: We retrospectively enrolled 173 Korean patients who were admitted in a mechanical intensive care unit of a university-affiliated tertiary care hospital between 2004 and 2013.

Results: Their median age was 65 years (range 19-91) and male was 115 (66.5%). One-year mortality was 69.4% (n=120). On day 21 of ventilator care, ProVent score value was 0 in 10 patients (5.8%), 1 in 58 patients (33.5%), 2 in 62 patients (35.8%), 3 in 31 patients (17.9%), and ≥ 4 in 12 patients (7.0%), respectively. For ProVent score values ranging from 0 to ≥4, one-year mortality rates were 50%, 60.3%, 69.4%, 87.1%, and 83.3%, respectively. The area under the curve of the receiver operating characteristic curve for the ProVent score was 0.64 [95% confidence interval (CI) 0.549 to 0.724, p=0.004). Stepwise logistic regression analysis showed that only one variable (thrombocytopenia) was independently associated with one-year mortality in our population (Odd ratio 5.655, 95% CI 2.150-14.871, p<0.001). One-year mortality rate in patients (n=54) with thrombocytopenia on day 21 was 89%.

Conclusions: In our study, one factor (thrombocytopenia) of the ProVent score was valid for one-year mortality in patients requiring PMV. In Korea, further validation of this ProVent score in a larger external sample would be needed.

Keywords: Ventilator, Prolonged mechanical ventilation, Provent score
EVALUATION OF THE FUNCTION OF PATIENTS IN CRITICAL LONG INVASIVE MECHANICAL VENTILATION

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Background/Purpose: The need for mechanical ventilation (MV) during acute critical illness, demonstrates a serious picture with high morbidity and mortality and delayed and limited after their hospital discharge functional recovery, so we used the Barthel index (BI), an instrument that evaluates the functionality and degree of dependence on their, after his discharge from the ICU daily physical activities. OBJECTIVE: To evaluate the functional recovery of critically ill patients with prolonged mechanical ventilation at 30 days and 180 days of their discharge.

Methods: Cohort study, analytical and observational made in the Regional Hospital of High Specialty Victoria (HRAEV). All critically ill patients under VMi prolonged (> 72) were studied in the period 2013-2014 were graduates of clinical improvement followed up 132 patients who met inclusion criteria: > 18 years, sedation (RASS -2) with VMi> 72 hrs, APACHE> 14, egress for improvement, was compared with group VMi not prolonged (<72hrs). The main dependent variables were functional capacity assessment by Barthel index scale (IB) before admission (baseline) to his discharge from the intensive care unit (ICU) and 180 days after discharge home. Independent secondary variables were demographic, metabolic, days of mechanical ventilation, nursing workload, hospital stay, mortality.

Results: 132 consecutive patients who met the inclusion criteria, age 51.8 ± 20.6, 51% female, 6.2 ± 4.5 days stay, days VMi 6.6 ± 4.4, 32.2 ± 10.1 NEMS income, 20.6 ± 9.2 NEMS egress, APACHE II 20.0 ± 5.4 were studied. Reason medical income 55.3%, 44.7% surgical, need amines 53.8%, 28.8% need inotropes, 15.8% mortality. IB at discharge UTI: severe Unit with APACHE 24.6 ± 4.2, moderate dependence APACHE 20.82 ± 3.3, 17.0 APACHE little dependence ± 4.2, 15.5 ± Independence APACHE 2.89. IB at discharge 180 days: 26.3 ± 3.89 Unit moderate, moderate dependence with APACHE 23.4 ± 3.9, 16.9 ± 3.9 independence. With VM> 72hrs a BI with severe dependence (<p 0.01), VM> 72 hrs with moderate dependence (<p 0.01). Norepinephrine an IB with severe dependence (<p 0.05). Mortality (15%) correlated with APACHE 26.2 ± 5.1 (18-34).

Conclusions: The VM> 72 hrs is associated with poor functionality and greater dependence at discharge from ICU patients recovering functionality after 180 days of monitoring, observing p = <0.05.

Keywords: VMi prolonged, Functionality
Clinical Medicine - Mechanical Ventilation

CLINICAL OUTCOMES IN PATIENTS WITH PROLONGED MECHANICAL VENTILATION

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Background/Purpose: In patients requiring prolonged mechanical ventilation, weaning is difficult and mortality is high. This study was to evaluate clinical characteristics and outcomes in patients receiving prolonged mechanical ventilation in intensive care unit (ICU).

Methods: We retrospectively reviewed 75 patients who received mechanical ventilation for at least 21 days in ICU at Chonnam National University Hospital between January 2005 and December 2010.

Results: The ICU mortality was 46.7%, and hospital mortality was 50.7%. Pneumonia (30.7%) was the most common reason for ICU admission and followed by post-cardiopulmonary resuscitation (24.0%) and acute respiratory distress syndrome (20%). 44 patients (58.7%) were successful to wean from the mechanical ventilation. Male, chronic liver disease and using of systemic steroids were associated with failure of weaning from prolonged mechanical ventilation. Chronic liver disease (Odds ratio [OR] 0.21, 95%CI 0.05-0.84; p=0.027), length of ICU stay (OR 1.03, 95%CI 1.00-1.06; p=0.024), and tracheostomy (OR 6.51, 95%CI 1.50-28.24; p=0.012) were independent factors for weaning from prolonged mechanical ventilation. Diabetes mellitus (OR 7.19, 95%CI 1.95-26.49; p=0.003), chronic liver disease (OR 9.619, 95%CI 2.25-41.21; p=0.002), and tracheostomy (OR 0.06, 95%CI 0.01-0.27; p=0.000) were independent prognostic factors for mortality in ICU during prolonged mechanical ventilation.

Conclusions: The mortality rate in patients with prolonged mechanical ventilation is high. Chronic liver disease, longer stay in ICU and tracheostomy were independent factors for weaning, and diabetes mellitus, chronic liver disease and tracheostomy were independent prognostic factors for ICU mortality during prolonged mechanical ventilation.

Keywords: Prolonged mechanical ventilation, Tracheostomy
MORTALITY IN PATIENTS WITH CARDIOPULMONARY PATHOLOGIES UNDER MECHANICAL VENTILATION

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Background/Purpose: Trends in mechanical ventilation (MV) have been changing over time, in order to ensure early release, decrease the stay, morbidity and mortality in ICU, this directly associated with the management and implementation of the parameters and ventilatory strategies.

Methods: A Descriptive, observational, retrospective cohort study made in adults who received MV for more than 12 hours in 2014. Data collected over a period of 60 days.

Results: A 100% (n = 70) of patients who received VM, 59% (n = 41) were male and 41% (n = 29) female; MV days on average were 5.3 ± 4.4 (SD) days (21.1). The overall mortality rate was 51.4% (n = 36) regarding specific mortality in patients undergoing pulmonary disease with MV was 57.9% (n = 22) and 43.8% (n = 14) for cardiovascular disease. The survival of patients was 48.6%. The conditions independently associated with increased mortality were related to patient management (OR, 2.89; 95%; p <0.03 for volume> 6 L * Kg and OR, 2.64; 95%; p <0.02 for the plateau pressure> 35 cm H2O).

Conclusions: The Survival of 48.6% patients (n = 34) is related with implementation of strategies for protective ventilation, since the highest mortality occurs in patients with underlying lung disease, requiring high tidal volumes and consequently increased plateau pressure, generating a mechanical stress by altering the architecture alveolar capillary membrane.

Keywords: Mechanical ventilation, Mortality, Cardiopulmonary
LEVEL OF KNOWLEDGE IN GUIDELINES FOR PREVENTION OF PNEUMONIA ASSOCIATED WITH MECHANICAL VENTILATION IN COLOMBIA

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Background/Purpose: Pneumonia associated with mechanical ventilation (NAV) is a complication with high prevalence in Colombian intensive care units. The objective is to determine the degree of knowledge of the health care professionals in charge to management of mechanical ventilation in 6 cities of Colombia.

Methods: A Cross-sectional descriptive study was made using a survey of 8 questions with closed answer, between January and August of 2012. It was conducted in six cities of Colombia (Palmira, Armenia, Tunja, Bogot, Monteria, Medellin) with the participation of 320 volunteer professionals.

Results: From those 320 evaluated, 45.3% (n = 145) correspond to respiratory therapists, 14.7% (n = 47) physiotherapists, 39.7% (n = 127) nurses, no response was received from 0.3% (n = 1). The average score was 30.3% for the range of 4 taking as maximum score 8 only 10% of the population earned the highest score. The linear regression analysis showed that years of experience (higher level) is independently associated with better scores (B = 0.55 ± (ES) 0.89) (95% CI (2.35 to 2.95) (p <0.005) and work in the intensive care unit with a smaller number of beds does not determine a linear relationship (B = 0.144 ± (ES) 0.10) (95% CI (1.98 to 2.1) (p <0.005).

Conclusions: Despite the existence of scientific guidelines for the prevention of pneumonia associated with mechanical ventilation, there is a large percentage of ignorance from health care workers in charge on Colombian intensive care units and is independent of the profession and years of experience.

Keywords: Pneumonia, Mechanical ventilation, Intensive care
CENTRAL VENOUS OXYGEN SATURATION COULD NOT BE A WEANING SUCCESS PREDICTOR FROM MECHANICAL VENTILATOR IN CRITICALLY ILL POST-CARDIAC SURGICAL PATIENTS

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Background/Purpose: This study was to evaluate the predictive capability of ScvO2 for predicting weaning success in critically ill post cardia surgical patients.

Methods: We prospective observed critically ill post-cardiac surgical patients who required mechanical ventilator (MV) between December 2011 and October 2014. All enrolled patients underwent the spontaneous breathing trial (SBT). Arterial and venous gas analysis, hemodynamic and ventilator parameters were recorded at SBT beginning (T1) and after SBT (T2). Weaning success was defined as successful extubation after the first SBT without re-intubation within 48 hours later. Area under the receiver characteristic curve (ROC) demonstrated the discriminative capability. The statistically significant was defined as p<0.05.

Results: A total 121 patients were included. Of these, 103 patients (85%) were success to wean from MV. There was no statistical significance in age, gender, and type of operations between groups. Regarding hemodynamic and respiratory parameters, the significant differences were found only in partial arterial oxygen pressure (PaO2; p=0.048) and PaO2 to oxygen fraction ratio (PF ratio; p=0.048) at T1. Neither T1 nor T2 of ScvO2 was statistical difference between groups. The area under the ROC (95% confidence interval) of ScvO2 was 0.60 (0.47-0.74) and 0.53(0.39-0.66) at T1 and T2 respectively. Although ScvO2 was combined with rapid shallow breathing index (RSBI), PF ratio and minute volume at both T1 and T2. The discrimination ability was not significantly increased.

Conclusions: ScvO2 or its combination with RSBI, PF ratio and minute volume could not be an accurate predictive for weaning success from mechanical ventilator critically ill post cardiac surgical patients.

Keywords: ScvO2, Weaning, Surgical ICU, Ventilator
THE ERROR OF TIDAL VOLUME OF THE VENTILATOR DURING INHALED HYDROGEN GAS ADMINISTRATION

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Background/Purpose: Inhaled hydrogen gas provides potent antioxidant and antiapoptotic properties against ALI in the animal models, and clinical application is ongoing. It is difficult however to correctly measure or monitor the flow and the tidal volume (VT) of the gas with hydrogen. We evaluated the error of VT monitored by a specific ventilator (Servo-i) during hydrogen gas administration.

Methods: First we constructed volume-pressure (V-P) lines by slow inflation with gas (oxygen with/without 1.5% hydrogen) using a computer-controlled 1 liter supersyringe. Then, a model lung was ventilated with Servo-i in volume-controlled ventilation mode: as the set VT, PEEP of 5 cmH₂O, VT of 200, 300, 400, 500, 600 mL, and FIO₂ 1.0 with and without 1.5% hydrogen. We compared the exhaled VT monitored by the ventilator and the actually delivered VT calculated from the driving pressure (plateau pressure minus PEEP) using V-P lines.

Results: The derived V-P line of 1.5% hydrogen was not identical to that of no hydrogen. The slope of line of 1.5% hydrogen was significantly smaller than that of no hydrogen: 21.5 vs 22.5 mL/cmH₂O : P<0.05 (as Figure 1). Hydrogen gas also affected the accuracy of the monitored VT. The smaller the set VT values were, the more conspicuous the discrepancy between the monitored and the delivered VT became (as Table 1).

Conclusions: Hydrogen gas affected a monitor function of tidal volume with Servo-i in volume-controlled ventilation mode. During hydrogen gas administration, the VT monitored by the ventilator was larger than the actually delivered VT to varying degrees.

Keywords: Hydrogen, Mechanical ventilation, Tidal volume
OPTIMUM POSITIVE END-EXPIRATORY PRESSURE LEVEL ESTIMATED BY GAS EXCHANGE AND MECHANICS OF LUNG/THORAX DURING LAPAROSCOPIC SURGERY

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Background/Purpose: Pneumoperitoneum and Trendelenburg position during laparoscopic surgery decrease the respiratory system compliance of patients and can lead to alveolar collapse and hypoxia. We compared several methods to evaluate optimal positive end-expiratory pressure (PEEP) level in patients with laparoscopic surgery.

Methods: In 5 patients undergoing robot-assisted laparoscopic prostatectomy, we measured PaO2/FIO2 (P/F) ratio and quasi-static compliance of lung/thorax (Cq) on levels of PEEP (2, 4, 6, 8, 10, and 12 cmH2O) during pneumoperitoneum and Trendelenburg position. We also measured Pressure-Volume (P-V) loop starting from zero end-expiratory pressure (ZEEP) every 30 minutes to evaluate changes of mechanics of lung/thorax sequentially over the 3 hours. The statistical analysis was conducted using one-way ANOVA with repeated measures with Tukey test as post-hoc analysis.

Results: P/F ratio and Cq increased significantly associated with the PEEP level (p < 0.05) and reached maximum values at PEEP of 10 cmH2O (Figure). No significant changes were found in regard to Lower inflection point (LIP), expiratory point of maximum curvature (PMC), and static compliance (Cstat) during operation. LIP and PMC on P-V loop were much higher than estimated from P/F (Table).

Conclusions: Lung mechanics represented by P-V loop in patients during pneumoperitoneum and Trendelenburg position is likely to be constant during operation. The optimum PEEP levels estimated by lung mechanics are greatly different from that by blood gas.

Keywords: Positive end-expiratory pressure, Laparoscopic surgery
A SYSTEMATIC REVIEW OF EFFECT OF SPONTANEOUS BREATHING TRIAL

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Background/Purpose: Such long-term mechanical ventilator care, along with increased length of hospital stay, may cause a considerable increase in the cost of care. Therefore, strategy to shorten the number of days on mechanical ventilation is important for minimizing complications and financial, physical, psychological burden. Especially, in South Korea, there is no experimental which use the spontaneous breathing trial (SBT) method. Thus, we aim to assess the effectiveness of using SBT by multidisciplinary approach and its influence through a systemic review about SBT for the purpose of successful ventilator weaning. Furthermore, we are going to review guidelines appropriate for local circumstances which may serve as a basis for future SBT-related studies.

Methods: This study is a systemic review and meta-analysis of randomized controlled clinical trials about SBT for weaning among adult patients on mechanical ventilation in ICU.

Results: we found that when SBT was administered the days of hospital stay were 1.38 days shorter on average (95% CI=0.29, 2.47). We divided the 7 articles into two groups: (1) four articles which compared SBT with non-protocolized weaning, and (2) three articles which compared SBT with auto-weaning, and compared effect sizes. The non-protocolized weaning group were 1.54 times more likely to have a successful weaning (95% CI=1.01, 2.33). Also, the length of ICU stay of the SBT group was on average 1.03 days shorter than that of the non-protocolized weaning group (95% CI=1.77, -0.29).

Conclusions: Our result suggests that implementing SBT is more helpful than non-protocolized weaning and auto-weaning program was significantly more effective than implementing SBT.

Keywords: Spontaneous breathing trial, Ventilator weaning
LUNG PROTECTIVE VENTILATION AND ITS LIMITATIONS

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Background/Purpose: Lung protective ventilation (LPV) is the main ventilatory strategy for acute respiratory distress syndrome (ARDS) patients and consists in to keep tidal volume ≤ 6 ml/kg, plateau pressure < 30 cmH2O and high positive end-expiratory pressure (PEEP) levels. The main objectives of this study were to observe and identify limitations for LPV in ARDS patients. Another objective was to observe mortality and its ratio with PEEP levels.

Methods: We observed 35 ARDS patients without brain injury and its respective data. Patients that presented plateau pressure > 30 cmH2O were analyzed regarding the data that were associated to this reason. The ventilators used were: Vela - CareFusion. Student t test, ANOVA, Fisher test and the Receiver Operating Characteristics Curves (ROC curve) were used as statistical analysis. A probability of less that 0.05 was considered statistically significant.

Results: Compliance of the respiratory system (Cst, rs) < 24 ml/cmH2O was the main variable related to Plateau pressure > 30cmH2O (sensitivity: 0.83; specificity: 0.94; area under the ROC curve: 0.90). Body weight > 78kg and tidal volume > 465 ml presented the area under the ROC curve of 0.78. Survivors were ventilated with higher PEEP levels than non survivors (14.8 ± 2.7 cmH2O x 12.7 ± 1.3 cmH2O; p = 0.006).

Conclusions: Patients with Cst, rs < 24 ml/cmH2O, body weight > 78kg and tidal volume > 465 ml presented high risk to high plateau pressure and lung injury. Low Cst, rs is the main variable related to LPV failure.

Keywords: Mechanical ventilation, Acute respiratory distress

Figure 1. Lung protective ventilation in a patient with ARDS and driving pressure of 15 cmH2O.
THE ASSOCIATION OF BODY TEMPERATURE WITH TOTAL MECHANICAL VENTILATION TIME

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Background/Purpose: Fever may affect the duration of mechanical ventilation requirement through the metabolic effect induced by fever. We investigated the association of fever with total mechanical ventilation time in critically ill patients with acute respiratory failure.

Methods: Subgroup analysis using propensity matching was conducted from a prospective, multicenter observational study. We enrolled critically ill patients required mechanical ventilation for more than 24 hours in 10 Korean and 15 Japanese intensive care units (ICUs) and recorded the maximal body temperature during ICU (MAXICU). We separately assessed the association of MAXICU and prolonged mechanical ventilation according to medical or surgical ICU admission.

Results: A total of 655 patients were included in the analysis. After propensity score matching, MAXICU ≥ 37.5 °C had significantly prolonged mechanical ventilation in both medical and surgical ICU admission, than MAXICU of 36.5 °C to 37.4 °C. In multivariate logistic regression analysis, odds ratios of MAXICU for prolonged mechanical ventilation in medical ICU admission were 3.14, 5.22, and 11.94 for increasing MAXICU (37.5 °C to 38.4 °C, 38.5 °C to 39.4 °C, and ≥ 39.5 °C, respectively). In surgical admission, after adjusting for all covariates, the odds ratio of MAXICU for prolonged mechanical ventilation were 4.36, 15.73, and 43.93 for MAXICU of 37.5 °C to 38.4 °C, 38.5°C to 39.4 °C, and ≥ 39.5 °C, respectively.

Conclusions: Our results suggest that fever independently associated with the total ventilation time in critically ill patients required mechanical ventilation for more than 24 hours. Moreover, the risk of prolonged mechanical ventilation significantly increases with the rise of body temperature.

Keywords: Body temperature, Intensive care unit, Prolonged mechanical ventilation, Fever
2015 NAGOYA AIRWAY MANAGEMENT USING NON-INVASIVE POSITIVE PRESSURE VENTILATION IN THE CRITICAL CARE

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Background/Purpose: In Nagoya University Hospital, non-invasive positive pressure ventilation (NPPV) is first-ly used for opening peripheral airways. We report the NPPV application in our ICU as Nagoya airway management.

Methods: We retrospectively surveyed all 1,431 cases managed in ICU from May 2011 to June 2014 then extracted cases which applied NPPV.

Results: NPPV were used for 145 cases (10.2%). Patient characteristics were 68.4±16.3 year-old, male/female ratio 100:45, staying for 11±10.9 days, APACHEII score 23.7±7.7, and PaO2/FiO2 ratio 182.5±115.6 just before NPPV induction, respectively. Heart failure 43 cases, pulmonary fibrosis 20 cases, and ARDS 18 cases were observed other than malignant diseases and fulminant myocarditis. The initial setting of NPPV was IPAP 8 cmH2O and EPAP 5 cmH2O. The ICU mortality was 22.8% (33 cases). APACHEII score was significantly high at 26.7±8.1. P/F ratio was notably low at 146.0±85.8 mmHg. The top cause of death was pulmonary fibrosis (13 cases, 9.0%).

Conclusions: We actively accommodate NPPV to open peripheral airways and regulating the low level of the inspiratory oxygen. The mortality rate was approximately 22.8% at APACHEII score 26.7.

Keywords: NPPV, Peripheral airway, Nagoya
IMPACT OF INITIAL MANAGEMENT ON RESPIRATORY COMPLICATIONS IN EMERGENCY DEPARTMENT PATIENTS REQUIRING MECHANICAL VENTILATION

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Background/Purpose: We designed this study to investigate risk factors for respiratory complications including ARDS in patients without initial lung injury admitted to intensive care unit (ICU) through emergency department (ED).

Methods: Following a retrospective review of clinical data and radiographic findings of the patients admitted to the ED from April to December, 2014, 100 patients who required MV at least one day for non-thoracic causes were enrolled. Respiratory outcomes within one week and the risk factors for respiratory complications were analyzed.

Results: The median age of the patients was 64 year (21-99) and 41% (n=41) were female. Of total 100 Patients requiring invasive MV, 43 cases (43%) were drug or chemical intoxication, 41% neurologic cause, 16% trauma. Mean tidal volume of initial ventilator mode with and without respiratory complications was 7.61 ± 1.49 mL/kg and 7.12 ± 2.14 (p = 0.24). Respiratory complications including ARDS (n=4), pneumonia (n=25), pulmonary embolism (n=2), and atelectasis (n=11) developed in 32 patients (32%). In-hospital mortality developed in 12 patients (12%). The factor associated with respiratory complications in logistic regression with multivariate analysis was the use of inotropes only (OR 3.66, 95% CI 1.24 - 10.80, p = 0.019).

Conclusions: Requiring inotropes during care in ED was an independent risk factor for respiratory complications including ARDS, while tidal volume was not associated with the outcomes. This finding might be resulted from routine apply of low tidal volume in most patients in ED of our hospital. Further studies to suggest proper ventilator setting will be needed.

Keywords: Mechanical ventilation, Lung injury
IMPACT OF HIGH-FREQUENCY OSCILLATORY VENTILATION ON CEREBRAL OXYGENATION OF NEUROCITICAL PATIENTS WITH REFRACTORY ACUTE RESPIRATORY FAILURE (RARF)

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Background/Purpose: FRAR in neurocritical patients hypoxia, compromise vital, functional outcome. Therapeutic (prone, extracorporeal oxygenation and HFOV) series with HFOV. Evaluated hemodynamic, oxygenation variables, cerebral, systemic, in patients with RARF with HFOV.

Methods: Observational study. Patients with RARF in HFOV, between 1/1/12- 6/30/13. Respiratory, hemodynamic and multimodal neuromonitoring (MMN) Follow up to six months. HFOV: protocol management. Hemodynamic monitoring (transpulmonary thermodilution), intracranial pressure (ICP), cerebral perfusion pressure (CPP), brain tissue oxygen pressure (pTiO2) and continuous jugular bulb oximetry (SjO2).

Results: 865 patients in ICU, (12 %) neurocritical, (46 %) on mechanical ventilation (MV), HFOV 6 patients, age 37 years ± 11 (35-65). Glasgow 11 ± 4 (4-14). APACHE II 27 ± 3.8 (25-34). SOFA to install HFOV 15 ± 3.7 (8-19). Significant improvement (p<0.05) in paO2 (70 to 148mmHg), PaFi (92 to 150), IOx (31 to 22), pTiO2 (13 to 31mmHg) and SjO2 (59 to 82%). No significant changes in systemic hemodynamic, PIC or CPP. During 5 days in HFOV evolved in ventilatory, gas exchange and cerebral oxygenation 6 (100%) acute renal failure, 4 (66%) polynuromyopathy, 2 (33%) TakoTsubo syndrome, 2 (33%) pneumonia, 2 (33%) pressure ulcers, and 2 (33 %) obstruction of endotracheal tube. 1 died in ICU with sepsis and multiple organ failure after disconnection of HFOV. Days in ICU 40 ± 30 (25-107). Mechanical ventilation for 31 days ± 9.6 (18-45). In HFOV 5 days ± 4 (5-15). In multimodal neuromonitoring 14 days ± 6 (2-18).

Conclusions: In our series, HFOV was associated with significant improvement in systemic and cerebral oxygenation without altering systemic and cerebral hemodynamic.

Keywords: Impact of high-frequency oscillatory ventilation
CORRELATION BETWEEN THE CBF AND ICP IN DECOMPRESSIVE CRANIECTOMY PATIENTS

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Background/Purpose: Increased intracranial pressure make the cerebral perfusion pressure decrease, in Traumatic brain injury patients. And decreased cerebral perfusion pressure may result in cerebral blood flow decrease. As a result decreased cerebral blood flow, make tissue hypoxia and activate the cascade of secondary brain injury mechanism. Authors tried to find out the correlations between the change of cerebral perfusion pressure and the cerebral blood flow.

Methods: Total 51 patients' clinical data were analyzed retrospectively. All these patients undertook decompressive craniectomy due to traumatic brain injury. These patients also had extraventricular drainage catheter and sensor of the thermal diffusion cerebral blood flow monitor, simultaneous after post-operative period. Paired data of cerebral blood flow and intracranial pressure were monitored every 2 hours.

Results: Cerebral perfusion pressure, range 50-150 mmHg, intracranial pressure and mean blood pressure changes didn't influence on the cerebral blood flow. But in cerebral perfusion pressure less than 50 mmHg, patients cerebral blood flow was influenced by mean arterial pressure and intracranial pressure.

Conclusions: Cerebral blood flow hardly influenced by the mean arterial pressure and intracranial pressure, while cerebral perfusion pressure was in autoregulation range. But out of this range, the patient cerebral blood flow was influenced by cerebral blood flow and intracranial pressure.

Keywords: Cerebral blood flow, Intracranial pressure, Decompressive craniectomy
TEMPERATURE DIFFERENCE BETWEEN THE AXILLARY AND TYMPANIC MEMBRANE IN HYPOTHERMIC PATIENTS

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Background/Purpose: The brain temperature is about 0.4 - 1°C higher than that of the other peripheral body area. But most of these results have been obtained in normothermic condition. The objective of this study is to evaluate the temperature difference between the brain and axilla, in patients under hypothermia.

Methods: Sixty-three patients (37 women and 26 men) who underwent craniotomy with implantation of the thermal diffusion flowmetry sensor were included in this study. The temperature of the cerebral cortex and axilla was measured every 2 hours, simultaneously. The patient group was divided according to axillary temperature hyperthermia (over 38°C), normothermia (36-38°C) and hypothermia (under 36°C). Total 1671 paired sample data were collected and analyzed.

Results: The temperature difference between the cerebral cortex and the axilla was 0.45 ± 1.04°C in hyperthermic patients, 0.97 ± 1.1°C in normothermic patients and 1.04 ± 0.81°C in hypothermic patients. The temperature difference has statistical significance in each group (unpaired t-test, P<0.05).

Conclusions: From our study the temperature difference between the brain and the axilla in hypothermic condition increased more than that of normothermic state. And in hyperthermic condition, the temperature difference decreased.

Keywords: Core temperature, Cortical temperature, Axillary temperature
INFLUENCE OF REGIONAL CORTICAL BLOOD FLOW AND CARBON DIOXIDE DIFFERENCE ON CRANIOTOMY PATIENTS

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Background/Purpose: Many kinds of prognostic factors have founded and given help to anesthesiological and neurosurgical practice. PETCO2 is often used as an estimate of PaCO2, with the understanding that PaCO2 usually exceeds PETCO2. During intraoperative craniotomies, because hyperventilation is used to therapeutically lower intracranial pressure, the difference between PaCO2 and PETCO2 (P(a-ET)CO2) has therapeutic implications. To determine how much information concerning neurosurgical operation and clinical outcome is provided by the end-tidal CO2, PaCO2 and P(a-ET)CO2 during surgery.

Methods: 81 patients who had taken neurosurgical operation were included in this study. There were 51 males and 30 females with a mean age of 50.3 years (range 7-85). All of these patients were under general anesthesia, body temperature was maintained in a normothermia, end tidal CO2 maintained 28-34 mmHg and kept the systolic blood pressure 90-120 mmHg. ETCO2, Blood gas analysis and regional cortical blood flows were checked at the end of operation procedure, dura closing time. Neurologic outcome was evaluated at 8 hours after the post-operation, for the sake of rule out other factors that may influence on the patient's long term outcome. Data were collected and compared by student t-test.

Results: The PaCO2 was 34.6 ± 5.2 mmHg (range, 24.9-54.8) and PETCO2 was 29.9 ± 4.1 mmHg (range, 20.0-45.0) and P(a-ET)CO2 was 4.7 ± 3.5 mmHg (range, -1.1 - 18.6). The correlation between the PaCO2 and PETCO2 was statistically significant (ETCO2=13.3 - 0.57 x PaCO2). But there was no correlation of rCoBF with PaCO2 and ETCO2. P(a-ET)CO2 values less than 8 mmHg correlated well with good neurologic outcome compared with higher P(a-ET)CO2 patients. PaCO2, rCoBF, mean arterial blood pressure, arterial pH and initial Glasgow coma scale show statistically significant correlation with neurologic outcome (P<0.05).

Conclusions: Based on our study, P(a-ET)CO2 value can be used as a good prognostic factor during the neurosurgical operation patients and anesthesiologist should try to decrease this value. And in patients who have an intact brain autoregulation, rCoBF was not influenced by PaCO2 and ETCO2, entirely.

Keywords: End tidal carbonic dioxide, Arterial blood gas analysis
REVERSE CUSHING PHENOMENON WHILE DECOMPRESSIVE CRANIECTOMY SURGERY

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Background/Purpose: Increased intracranial pressure (ICP) elicits Cushing response in vital signs: hypertension, bradycardia, and respiratory irregularities. Therefore theoretically, it is expected that decreased ICP due to decompressive craniectomy for uncontrolled IICP can restore systemic blood pressure and pulse rate. Because this issue has not been previously studied, authors were prospectively designed to investigate the influence of decompressive craniectomy on systemic arterial blood pressure and pulse rate.

Methods: 45 patients who had taken decompressive craniectomy to prevent uncontrollable intracranial hypertension were included in this study. These patients’ vital signs were monitored during the decompression surgery. All of these patients were under general anesthesia, respiration and body temperature were maintained in a steady state. Systemic mean arterial blood pressure and pulse rate were compared before and after the craniectomy with 2 minute intervals. Data from 20 minutes before and 30 minutes after the decompressive craniectomy were collected and compared by unpaired sample t-test.

Results: The intracranial pressure was decreased from 42.6 ± 19.4 to 6.8 ± 7.5 cmH2O, and mean arterial blood pressure was decreased from 89.3 ± 15.2 to 72.3 ± 9.4 mmHg, after the decompressive craniectomy (P<0.05). The pulse rate was not changed significantly (P>0.05). These decreased mean arterial pressures were spontaneously restored about 20 minutes after the craniectomy without any intervention. But in 9 patients who had cardiopulmonary problems, there were no correlations between the ICP and mean arterial pressure changes.

Conclusions: Based on our study, we observed that reduced ICP due to decompressive craniectomy for uncontrolled IICP decreased systemic blood pressure for about 20 minutes after the procedure, but didn’t influence on the pulse rate. A large number of patients need to determine the robustness and the clinical usefulness of this response.

Keywords: Cushing phenomenon, Blood pressure, Pulse rate, Intracranial pressure
SPONTANEOUS INTRACRANIAL HEMORRHAGE IN CRITICALLY ILL PATIENTS WITH MALIGNANCIES

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Background/Purpose: Limited data are available on intracranial haemorrhage (ICH) developed in critically ill cancer patients during their stay in the intensive care unit (ICU). The purpose of this study is to evaluate the clinical characteristics of ICH and to identify predictors of ICH in critically ill cancer patients who underwent brain computed tomography (B-CT) for suspicion of spontaneous ICH.

Methods: All consecutive patients who underwent B-CT for suspicion of spontaneous ICH with acute neurologic symptoms or signs developed during their ICU stay were retrospectively evaluated to identify predictors of ICH.

Results: A total of 273 patients underwent B-CT scanning for suspicion of ICH, with altered mentality in 202 (74%), seizure in 43 (16%), and hemiparesis in 34 (13%). However, only 49 (18%) patients had a final diagnosis of ICH. The most common type of haemorrhage was intracerebral in 34 patients (69%), followed by subarachnoidal haemorrhage in 17 (35%). In multiple logistic regression analysis, anisocoric pupils or abnormal pupil reflex (adjusted OR 7.939; 95% CI, 2.315 - 27.228) was an independent predictor of ICH. In addition, higher positive end-expiratory pressure (adjusted OR 1.204; 95% CI, 1.065 - 1.361) was significantly associated with ICH. However, platelet count was inversely associated with ICH (adjusted OR 0.993; 95% CI 0.988 - 0.999).

Conclusions: Approximately 18% of critically ill cancer patients diagnosed with ICH when underwent B-CT scanning for suspicion of spontaneous ICH during their ICU stay. Our results suggest that B-CT scanning in critically ill cancer patients should be limited to selected patients with predictive factors for ICH.

Keywords: Critical illness, Cancer, Intracranial hemorrhage
ISCHEMIC STROKE IN CRITICALLY ILL CANCER PATIENTS WITH AND WITHOUT CONVENTIONAL MECHANISMS

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Background/Purpose: A few studies have reported mechanisms of ischemic stroke (IS) in the critically ill cancer patients. We investigated the clinical characteristics and precise mechanisms of IS in critically ill cancer patients.

Methods: All patients were retrospectively evaluated who underwent brain magnetic resonance imaging (B-MRI) for suspicion of IS with acute abnormal neurologic symptoms or signs developed in the oncology medical intensive care unit of Samsung Medical Center from March 2010 to February 2014. We compared clinical feature, risk factors, B-MRI patterns, and laboratory findings between patients with the cryptogenic (cancer-related stroke) and conventional stroke mechanism (CSM).

Results: Over the study period, a total of 88 cancer patients underwent B-MRI scanning for suspicion of IS. 43 (49%) patients had a final diagnosis of IS. 27 (63%) patients had the cryptogenic mechanism and 16 (37%) patients had the CSM. The levels of D-dimer were higher in the cryptogenic group (median level of 10.00 (3.77-17.72) mcg/dL) than CSM group (median level of 2.60 (1.50-3.74) mcg/dL). The area under the curve for prediction of cryptogenic mechanism was 0.802 (95% CI, 0.652-0.908) for D-dimer. In multivariate analysis, D-dimer levels of > 3.9 mcg/dL (adjusted OR 27.453; 95% CI, 1.382-545.322) and the diffusion-weighted imaging (DWI) lesion pattern of multiple vascular territories (adjusted OR 37.610; 95% CI, 2.364-598.329) were significantly associated with the cryptogenic group in critically ill cancer patients.

Conclusions: The levels of D-dimer and the DWI lesion pattern may be helpful to evaluate precise mechanism and treat IS in critically ill cancer patients.

Keywords: Ischemic stroke, Cancer, D-dimer, Intensive care unit
DIFFUSION-WEIGHTED IMAGING IMPROVE PROGNOSTICATION POWER IN PATIENTS WITH THERAPEUTIC HYPOTHERMIA AFTER CARDIAC ARREST

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Background/Purpose: To evaluate the role of diffusion-weighted imaging (DWI) in the comatose patients who received therapeutic hypothermia (TH) after cardiac arrest (CA).

Methods: MRI was performed in the comatose patients on TH 72 hours after CA per protocol. Clinical outcome was assessed with CPC. DWI findings, laboratory data, and clinical parameters were analyzed. The voxels below different ADC thresholds were calculated at 50 x 10-6 mm2/sec intervals, and % brain volume cut-off was estimated. Qualitative analysis of various brain region was conducted.

Results: 54 patients received MRI were included in the study. When the volume less than ADC value 550 x 10-6 mm2/sec was bigger than 7.5% of brain volume or the volume less than ADC value 650 x 10-6 mm2/sec was bigger than 17.8% of brain volume, the sensitivity was 67.7% and 64.5%, respectively with a specificity of 95.7% for all (by ROC analysis; AUC, 0.804 and 0.794). Positive predictive value of poor outcome was 100% when ADC value 550 x 10-6 mm2/sec was bigger than 10.9% or ADC value 650 x 10-6 mm2/sec was bigger than 27.6% or ADC value 700 x 10-6 mm2/sec was bigger than 38.2% of brain volume. Analysis of diffusion restriction in the different cortical and subcortical structures revealed basal ganglia, thalam, and occipital lobe as the most appropriate target (sensitivity, 74.9%, 71%, 77.4%; specificity 91.3%, 91.3%, 82.6%, respectively; AUC, 0.806 to 0.841) for poor prognosis.

Conclusions: Using both quantitative and qualitative analysis, DWI can improve the power of prognostication in patients with therapeutic hypothermia after cardiac arrest.

Keywords: Therapeutic hypothermia, Diffusion-weighted imaging, Cardiac arrest, Prognosis, Magnetic resonance imaging
NEURO SIRS IN POOR GRADE ANEURYSMAL SUBARACHNOID HEMORRHAGE: TARGET-GUIDE MANAGEMENT WITH MULTIMODAL NEUROMONITORING AND TRANSPULMONARY THERMODILUTION SYSTEMS

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Background/Purpose: Systemic Inflammatory Response Syndrome (SIRS) is a serious complication in neurocritic. It presents in any moment of the evolution and worsens the prognosis. It is called NeuroSIRS and its treatment is very complex. Patients Aneurysmal Subarachnoid Hemorrhage (ASH) presented NeuroSIRS display difficult challenge in fluid and vasoactive drugs management, due to interference between cerebral and cardiological haemodynamics, impact over other systems (pulmonary, renal). Our objective is to measure haemodinamics, respiratory and laboratory changes in ASH patients that required multimodal neuromonitoring and transpulmonary thermodilution monitoring.

Methods: Observational study. Neurocritical patients ASH, between 1/1/13 and 1/31/14, multimodal neuromonitoring and transpulmonary thermodilution monitoring. Major general characteristics, laboratory, respiratory, continuous hemodynamic (transpulmonary thermodilution), and multimodal neuromonitoring (intracranial pressure (ICP), cerebral perfusion pressure (CPP), brain tissue oxygen pressure (ptiO2) and continuous jugular bulb oximetry (SjO2) were recorded. Follow up to six months.

Results: 12 poor grade ASH patients. 8 women (67%), age 57 years ± 11. 10 ACA (83%). All early aneurism treatment: 8 coiling (67%) 4 clipped (33%). 9 Vasoespasm in Transcranial Doppler or AngioCT. All multimodal neuromonitoring transpulmonary thermodilution monitoring. 4 (33%) early NeuroSIRS. 6 NeuroSIRS associate to vasospasm. 4 patients died (33%)

Conclusions: Poor grade ASH is related to high frequency NeuroSIRS. Early fall in vascular resistance, low intrathoracic blood volume, inadequate cardiac response, increase extralung intrathoracic water, temperature, C-Reactive Protein and leukocytosis raise, without microbiological findings and normal Procalcitonine, respiratory deterioration, worsening in Cerebral Haemodinamics, with or without ICP increase, high Intraabdominal Pressure, acute kidney injury and multiple organ failure. required target-guided management prevent cardio-pulmonary-cerebral interactions.

Keywords: Systemic inflammatory response syndrome, Aneurysmal subarachnoid hemorrhage
NEURORREGENERATIVE THERAPY IN ACUTE NEUROCRITICAL CARE PATIENTS

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Background/Purpose: Sometimes without etiological findings, its called NeuroSIRS and its treatment is very complex. Patients with poor grade Aneurysmal Subarachnoid Hemorrhage (ASH) who presented NeuroSIRS display a difficult challenge in fluid and vasoactive drug management.

Methods: Observational study. Neurocritical patients with ASH, between 1/1/13 and 1/31/14, such gravity required multimodal neuromonitoring and transpulmonary thermodilution monitoring. Major general characteristics, laboratory, respiratory, continuous hemodynamic (transpulmonary thermodilution), and multimodal neuromonitoring (intracranial pressure (ICP)).

Results: 12 poor grade ASH patients. 8 women (67%), age 57 years ± 11. 10 anterior circulation aneurism (83%). All patients receive early aneurism treatment (before day 2): 8 coiling (67%) and 4 clipped (33%). 9 Vasoespasm in Transcranial Doppler or AngioCT. All patients under multimodal neuromonitoring and transpulmonary thermodilution monitoring. 4 patients (33%) show early NeuroSIRS (before surgery). 6 patients presented NeuroSIRS associate to vasospasm. In Figure we show relationship between cerebral and systemic haemodinamics, fluid and vasoactive drugs management and respiratory and renal function evolution. 4 patients died (33%) in the follow up.

Conclusions: In our series, poor grade ASH patients relate to high frequency NeuroSIRS. Early fall in vascular resistance, low intrathoracic blood volume, inadequate cardiac response, increase extralung intrathoracic water, temperature, C-Reactive Protein and leukocytosis raise, without microbiological findings and normal Procalcitonine, respiratory deterioration (low PaFi and high Oxigenation Index), worsening in Cerebral Haemodinamics (low ptiO2, normal or low SjO2, normal or low CPP), with or without ICP increase, high Intraabdominal Pressure, Acute Kidney Injury and multiple organ failure, characterized NeuroSIRS in ASH patients.

Keywords: Neurorregenerative therapy, Acute neurocritical care
ASSESSMENT OF THE EFFECTIVENESS OF TRAINING IN NEUROLOGY PATIENTS USING WARFARIN

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Background/Purpose: Warfarin is the most widely used anticoagulant around the world. INR is used in the control and monitoring of warfarin treatment. Targeted INR levels in patients with brain-heart infarction must be between 2 and 3. Patient training plays a key role in achieving these results. The study was carried out between February and November 2014 in order to assess the effectiveness of the training given with regard to the drug to patients who started to use warfarin as a result of neurologic diseases.

Methods: The population of the study consisted of 56 inpatients in the clinic of neurology, and the sample consisted of 32 patients in total, who regularly came to INR control each month. The training program prepared based on the literature was given to the patients, using one-to-one training technique on the day they started using warfarin. The INR levels in the first, second and third months following the training were checked. Data obtained from the study were assessed using the program IBM SPSS Statistics 22. Alongside with defining statistical methods, Mann-Whitney U test, and Friedman and Wilcoxon signed rank test were used in the comparison of quantitative data. The significance was found at the level of (p<0.05).

Results: The age average of the cases was 66.5±15.21. It was determined that 71.9% of the patients suffered from hypertension, 37.9% from diabetes mellitus, and 28.2% from left middle cerebral artery infarction plus dysarthria. While the INR level of 9.4% of the cases before the training was between the expected range, this ration became 35.2% (p=0.057) in the first month following the training, 40.6% (p=0.021) in the second month and 46.9% (p=0.004) in the third month. In the comparison of the INR levels before and after the training, it was observed that the INR level in the second and third month following the training in many parameters were statistically significantly higher when compared to the first month (p<0.05).

Conclusions: In the study, it was observed that the training given individually was quite effective in increasing the levels of information of the patients on warfarin and achieving the effective INR level.

Keywords: Nurse, Anticoagulant, Patient training, Warfarin
SPONTANEOUS TRANSPYLORIC PASSAGE OF ENTERAL FEEDING TUBE IN INTENSIVE CARE UNIT PATIENTS

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Nagoya City West Medical Center, Japan

Background/Purpose: The administration of enteral feeding is recommended in ICU patients. Although it remains controversial whether post-pyloric feeding is more beneficial than gastric feeding, post-pyloric feeding is preferable for certain patients. Guidance of the tube placement into the duodenum by radiologic or endoscopic maneuvers is usually required. We found that the tip of the feeding tube could proceed to the duodenum spontaneously in ICU patients. [Objective] To evaluate the success rate of spontaneous transpyloric passage of an enteral feeding tube in critically ill patients under respiratory support.

Methods: We retrospectively investigated patients in whom transpyloric feeding tube placement propelled by peristalsis was attempted from March, 2012 to December, 2014.

Results: A total of 66 trials in 56 patients were performed. Spontaneous transpyloric passage occurred in 59% of patients within 24 hours, in 79% within 48 hours, and in 93% within 3 days. Spontaneous placement was abandoned in only one patient, who had undergone gastrectomy, and transpyloric passage was accomplished in this patient with the aid of fluoroscopy.

Conclusions: Enteral feeding tube placement in the duodenum by peristalsis can be achieved with a high success rate at the bedside without any radiographic or endoscopic guidance.

Keywords: Feeding tube, Postpyloric feeding, Nutrition
EFFECT OF ENTERAL AND/OR PARENTERAL GLUTAMINE SUPPLEMENTATION ON MORTALITY AND MORBIDITY IN CRITICALLY ILL PATIENTS

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Background/Purpose: Glutamine supplementation has been generally accepted especially in critically ill patients. The arguments have lately increased on route of glutamine application, even if the idea of parenteral glutamine is superior to enteral administration has gained importance, a defined result has not been put on the record. In this study, we aimed to compare the effectiveness of enteral, parenteral and combined enteral-parenteral glutamine supplementations in nutrition of the critical care patients.

Methods: This is a single-center, randomized-controlled clinical trial. During the 5-day study period, all patients received standard enteral nutrition product and were divided into three groups, including parenteral glutamine (Group I), enteral glutamine (Group II) and enteral+parenteral glutamine (Group III) supplementations. Blood biochemistry, rates of infections, length of stay in intensive care unit and duration of mechanical ventilation were evaluated.

Results: Sixty patients (20 patients in each group) were included; 39 males (65%), 21 females (35%); age range, 18-80 years (56.45±18.81). There were no significant differences in demographic data, patient characteristics, diagnosis at admission, types of patients. Laboratory values were given in table 1. The length of stay in intensive care unit and duration of mechanical ventilation was shown in table 2. There was no statistically significant difference between the groups according to developing infections but frequency of infection ranged as Group II>Group III>Group I (Table 2).

Conclusions: Although mortality was not significantly different between groups, parenteral glutamine administration causes less stay of intensive care unit and mechanical ventilation. It needs more powerful randomized controlled study.

Keywords: Glutamine, Nutrition
Table 1

<table>
<thead>
<tr>
<th>Types of Infections</th>
<th>Group I n=20</th>
<th>Group II n=20</th>
<th>Group III n=20</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with no infection</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Patients with at least one infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>4</td>
<td>20.0</td>
<td>7</td>
<td>35.0</td>
</tr>
<tr>
<td>Bloodstream</td>
<td>3</td>
<td>15.0</td>
<td>6</td>
<td>30.0</td>
</tr>
<tr>
<td>Urinary</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Total number of infections</td>
<td>7</td>
<td>35.0</td>
<td>15</td>
<td>75.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length of stay in ICU (day)</th>
<th>Mean±SD</th>
<th>Mean±SD</th>
<th>Mean±SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of MV (day)</td>
<td>8.3±4.1</td>
<td>16.2±8.2</td>
<td>11.0±5.2</td>
<td>0.001</td>
</tr>
<tr>
<td>Mortality</td>
<td>7.0</td>
<td>35.0</td>
<td>8.0</td>
<td>40.0</td>
</tr>
</tbody>
</table>

NS: Not Significant

MV: Mechanical Ventilation

Table 2

<table>
<thead>
<tr>
<th>Group I n=20</th>
<th>Group II n=20</th>
<th>Group III n=20</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. cholestrol day 1</td>
<td>130.0±87</td>
<td>128.3±87</td>
<td>137.4±400</td>
</tr>
<tr>
<td>T. cholestrol day 5</td>
<td>128.3±87</td>
<td>138.3±300</td>
<td>134.7±333</td>
</tr>
<tr>
<td>T. protein day 1</td>
<td>5.8±87</td>
<td>6.0±90</td>
<td>5.8±85</td>
</tr>
<tr>
<td>T. protein day 5</td>
<td>5.9±90</td>
<td>5.8±85</td>
<td>5.8±83</td>
</tr>
<tr>
<td>Albumin day 1</td>
<td>3.0±03</td>
<td>3.1±21</td>
<td>3.0±09</td>
</tr>
<tr>
<td>Albumin day 5</td>
<td>2.9±72</td>
<td>3.0±22</td>
<td>3.0±38</td>
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<tr>
<td>ALT day 1</td>
<td>96.4±57</td>
<td>179.2±70</td>
<td>164.9±333</td>
</tr>
<tr>
<td>ALT day 5</td>
<td>43.3±27</td>
<td>40.8±45</td>
<td>42.3±100</td>
</tr>
<tr>
<td>AST day 1</td>
<td>104.9±87</td>
<td>243.7±69</td>
<td>142.5±333</td>
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<tr>
<td>AST day 5</td>
<td>50.1±33</td>
<td>68.4±53</td>
<td>45.3±333</td>
</tr>
<tr>
<td>WBC day 1</td>
<td>16.4±83</td>
<td>9.4±82</td>
<td>15.9±00</td>
</tr>
<tr>
<td>WBC day 5</td>
<td>11.8±85</td>
<td>5.3±76</td>
<td>13.2±60</td>
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<tr>
<td>ESR day 1</td>
<td>46.0±67</td>
<td>35.6±54</td>
<td>35.6±00</td>
</tr>
<tr>
<td>ESR day 5</td>
<td>42.2±67</td>
<td>38.9±02</td>
<td>39.9±33</td>
</tr>
<tr>
<td>CRP day 1</td>
<td>13.7±4</td>
<td>8.3±6</td>
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<tr>
<td>CRP day 5</td>
<td>6.9±5</td>
<td>4.7±6</td>
<td>7.1±7</td>
</tr>
</tbody>
</table>

NS: Not Significant

Poster Presentation
CONSTIPATION IN CRITICAL ILL PATIENTS WITH ENTERAL NUTRITION, OPIOIDS AND SEDATIVES

Graciela Beatriz Cueto, Margarita Adriana Torres Boden, Jorge Raul Rodriguez, Aldo Jorge Caruso, Jorge Luis Lodeiro, Gabriel Melnik, Susana Blasco Diez, Fabiana Torres

Intensive Care, Hospital C Argerich, Argentina

Background/Purpose: Opioids are used continuously in critically ill patients for pain, tolerance improvement of ventilatory support, response reduction to stress and anxiety, facilitating this adaptation. However this effect is linked to undesirable reactions on the central nervous system, cardiovascular system and gastrointestinal tract. Objective: Evaluate the frequency of constipation plus enteral nutrition (EN) in critical ill patients receiving opioids and sedatives as part of their treatment.

Methods: Prospective, observational, non interventional study, implemented in a 20 bed adult ICU. Variables analyzed were opioid type, opioid doses and enteral nutrition (ml/hr), catharsis event, Apache II score at admission and SOFA score at admission and 3th, 5th and 7th day. Constipation was defined as bowel movement frequency less than 3 times weekly.

Results: Study has 74 patients, mean of age was of 55 ± 17, Apache II was 22 ± 7 and SOFA 8 ± 3.5 at admission. Mortality was 19%. Constipation was detected in 53 patients (pt) (71.6%). Fentanyl FN was used in 50 pt (68%), Ramifentanyl RF in 14 pt (19%) and midazolam MZ in 51 pt (69%). In all constipation cases, the combination of FN+MZ was 58.5%, RF+MZ was 15% and other opioids was 26.4% (X2 2.27 p NS).

Conclusions: Constipation was present in near to 72% of all pt. FN was the more used opioid in pt. FN + MZ was administered in more tan a half of constipation cases. We suspect that constipation represents a bowel dysfunction and must be prevented and treated.

Keywords: Constipation, Opioids, Sedatives, Enteral nutrition
ENTERAL NUTRITION AND PARENTERAL NUTRITION IN CRITICALLY ILL PATIENTS IN NAGOYA UNIVERSITY 2011-2014

Michiko Higashi, Yudai Takatani, Takuga Hinoshita, Hitoshi Umino, Takanori Yamamoto, Masato Inaba, Tadashi Ejima, Atsushi Numaguchi, Miwako Kado, Hideo Takahashi, Naoyuki Matsuda

Department of Emergency & Critical Care Medicine, Nagoya University Graduate School of Medicine, Japan

**Background/Purpose:** The purpose of this analysis is to evaluate the relation between nutrition management methods and the outcome in emergency and medical intensive care unit (ICU).

**Methods:** We investigated retrospectively the patients hospitalized for 48 hours or more, in the ICU of Nagoya University hospital in Japan, from May 2011 to March 2014. According to the first nutrition method, the patients were classified into the following three groups: peroral intake group (PO), enteral nutrition group (EN), and parenteral nutrition group (PN). Enteral nutrition group was classified into the following four groups, according to the time to initiate enteral feeding: within 6 hours (EN6), 6-24 hours (EN6-24), 24-48 hours (EN24-48), and 48 hours or more (EN48). We evaluated APACHEII score and mortality in ICU of each group.

**Results:** 506 cases were met criteria of this study. 260 cases (51.4%) were classified into enteral group: EN6 38 (14.6%), EN6-24 113 (43.5%), EN24-48 79 (30.4%) and EN48 30 (11.5%). The mean of the APACHE II score was 28.6, 29.8, 29.5 and 29.4, and the ICU mortality was 1 (2.6%), 10 (8.8%), 4 (5.1%) and 4 (13.3%), respectively. PN was 45 cases. The mean of the APACHE II score was 28.1 and its ICU mortality was 7 (15.6%). EN showed the significantly better outcome than PN in spite of the similar severity.

**Conclusions:** This study showed that beginning enteral nutrition early could lead to better prognosis of critically ill patients.

Keywords: Enteral nutrition, Parenteral nutrition, Critically ill patients
ASSOCIATION BETWEEN SERUM PHOSPHORUS LEVELS AND OREXIGENIC AND ANOREXIGENIC HORMONES LEVELS IN CRITICALLY ILL PATIENTS

Ramazan Coskun¹, Ender Dogan², Kursat Gundogan¹, Gulseren Elay¹, Ilhan Bahar¹, Sabahattin Muhtaroglu³, Thomas Ziegler⁴, Murat Sungur¹, Muhammet Guven¹

¹Erciyes University Faculty of Medicine Internal Medicine Intensive Care Unit, Turkey, ²Erciyes University Faculty of Medicine Internal Medicine, Turkey, ³Erciyes University Faculty of Medicine, Department of Biochemistry and Clinical Biochemistry, Turkey, ⁴Emory University, School of Medicine, Division of Endocrinology, Metabolism and Lipids, United States

Background/Purpose: Refeeding hypophosphatemia is common in critically ill patients and it is associated with high morbidity and mortality, but influence on appetite-regulating orexigentic and anorexigentic hormones are unknown. The primary aim of this study was to determine the association with changes in serum concentrations of phosphorus and specific appetite-regulating hormones in critically ill patients.

Methods: A total of 26 patients admitted to the intensive care unit (ICU) between May 2013 and January 2014 were prospectively followed. The association between serum orexigentic and anorexigentic hormone levels and serum phosphorus levels before feeding, 24 and 72 hours after feeding were analyzed. Correlations between the specific hormone levels and the influence of route of feeding was also studied.

Results: Of the 26 cases; nine were female and seventeen were male. Fourteen (54%) of the patients were fed by the enteral route. Before feeding was initiated there was statistically significant positive correlation between serum leptin and IGF-1 levels and between serum ghrelin and phosphorus levels (r=0.458 p=0.019 and r=0.652 p=0.001, respectively). At 72 hours after feeding serum IGF-1 and resistin levels and resistin and GLP-1 levels were negatively correlated (r=-0.440 p=0.024, r=-0.453 p=0.020). Serum resistin levels were significantly lower in enteral feeding group compared to parenteral feeding group (p=0.015)

Conclusions: Serum phosphorus levels are significantly associated with the orexigentic hormones ghrelin and adiponectin early in the ICU course. Significant associations between serum orexigentic and anorexigentic hormone levels occur in the initial 3 days after ICU admission.

Keywords: Refeeding hypophosphatemia, Orexigentic and anorexigentic hormone
CLINICAL USEFULNESS OF CAPNOGRAPHIC MONITORING FOR FEEDING TUBE INSERTION IN CRITICALLY ILL PATIENTS: BEFORE AND AFTER STUDY

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_Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea_

**Background/Purpose:** Decreased or delirious mentality and intubated state is a risk factor for respiratory malpositioning of feeding tubes in critically ill patients. We investigated usefulness of capnographic monitoring to prevent respiratory tract malpositioning during feeding tube insertion in critically ill patients.

**Methods:** This study is before and after study, and total 459 feeding tube placements were retrospectively studied in the medical and surgical intensive care units of Samsung Medical Center. Feeding tubes had been inserted in 275 cases, and monitoring was not performed during tube insertion from August 2014 to October 2014. 184 cases of capnographic monitoring were performed from December 2014 to January 2015. We excluded feeding tube placements in November as window period. We compared before and after capnographic monitoring. Chest X-ray was performed to confirm the position of feeding tube in all feeding tube placements.

**Results:** 14 cases of respiratory malpositioning were detected in non-monitoring group (14/275, 5.1%, ten tracheal insertions and four pneumothoraces). 3 cases of respiratory malpositioning were detected in capnographic monitoring group (3/184, 1.6%, two tracheal insertions and one pneumothorax). CO₂ detection in capnographic monitoring group was 12 cases (12/184, 6.5%) and complication (pneumothorax) was reported in 1 case. False negative of capnographic monitoring was 1.1% (tracheal insertion of feeding tube, but CO₂ was not detected in two tube placements). Respiratory complications were much less in capnographic monitoring group (adjusted OR 0.155; 95% CI, 0.032-0.747).

**Conclusions:** Capnographic monitoring is useful to prevent respiratory tract malpositioning during feeding tube insertion in critically ill patients.

Keywords: Capnographic monitoring, Feeding tube, Intensive care unit
CONTINUOUS VS. INTERMITTENT ENTERAL FEEDING IN CRITICALLY ILL PATIENTS: A PROSPECTIVE, RANDOMIZED CONTROLLED TRIAL

Jung-kyu Lee, Ju-hee Park, Junghyun Kim, Soo Jung Kim, Sang-min Lee, Jinwoo Lee

Seoul National University Hospital, Republic of Korea

Background/Purpose: We aimed to determine if continuous enteral feeding via a nasogastric tube (continuous infusion via feeding pump for 24 hours) as an initial nutritional method would improve the nutritional status compared with intermittent feeding (regular infusion divided 4 times a day) in the critically ill patients requiring mechanical ventilation.

Methods: A prospective, randomized, open-labeled, controlled trial was conducted from June 2014 to December 2014. Adults who were required to apply mechanical ventilation and intended to start enteral feeding by physicians were randomized to receive either continuous or intermittent enteral feeding for the first 7 days.

Results: Thirty included patients were predominantly male (80%), with a mean age of 68.5 years and a mean APACHE II score of 22.3. Baseline characteristics were similar between continuous (n=15) and intermittent (n=15) enteral feeding groups. In continuous feeding groups, higher achievement rate for target calorie and faster arrival at target calorie were observed compared with intermittent feeding groups, but without statistical significance (80.8 ± 12.7% vs. 75.0 ± 20.5%, P=0.548; 2.67 ± 0.87 days vs. 2.82 ± 0.60 days, P=0.508). The achievement rate of target calorie in day 1 was significantly higher in continuous feeding group (70.4 ± 14.5% vs. 52.1 ± 13.8%, P=0.001). Continuously fed patients showed a trend of less gastrointestinal intolerance, especially diarrhea and vomiting/aspiration, compared intermittent group (8.6 ± 15.1% vs 18.1 ± 29.3%, P=0.501).

Conclusions: The continuous enteral feeding may facilitate early achievement of the nutritional target with less gastrointestinal intolerance, compared to intermittent feeding in critically ill patients requiring mechanical ventilation.

Keywords: Enteral nutrition, Intensive care units
THE STUDY OF FUNGAL CONTAMINATION IN THREE CURRENT PACKED SPICES (TURMERIC, BLACK PEPPER AND CINNAMON) IN THE MARKETS OF TEHRAN, IRAN

Roshanak Daie Ghazvini¹, Seyed Jamal Hashemi², Ali Asfia³, Shima Asfia⁴

¹Department of Medical Mycology and Parasitology, School of Public Health, Tehran University of Medical Sciences, Iran, ²Food Microbiology Research Center, Tehran University of Medical Sciences, Iran, ³Faculty of Mechanical Engineering, Shahid Rajaee Training University, Iran, ⁴Department of Biological Sciences, Shahid Beheshti University, Iran

Background/Purpose: Spices (flavorings) are contaminated to microbial agents such as fungi. The aims of this project were the study of fungal contaminations of three current spices including turmeric, black pepper and cinnamon from some supermarkets in Tehran and evaluating of their hygienic quality.

Methods: In this cross sectional study that was performed in laboratory of Medical Mycology, School of Public Health in Tehran University of Medical Sciences from Dec. 2012 to Sept. 2014, 165 packed spices including each 55 samples from 11 valid brands of cinnamon, turmeric and black pepper were selected. Culture was performed on many different fungal media from 10-1 to 10-4 dilutions of their samples. The fungal colonies obtained from cultures were studied by traditional laboratory methods and counted.

Results: Totally, from 165 packed spices, 4317 colonies include 29 different fungal species were isolated and identified from cinnamon (1520), turmeric (1373) and black pepper (1424). The etiologic agents were mainly Aspergillus niger (7.3%), Penicillium spp. (4.1%), Paecilomyces spp. (2.8%) and Aspergillus flavus (2.3%), respectively. Non-parametric Kruskal-Wallis test indicated that there was no significant difference statistically among brands at each level. Also the present study showed P = 0.0003 among under study spices. The most contaminated spices were cinnamon, while turmeric had the lowest contamination rate.

Conclusions: The obtained results of this cross-sectional study and the available proofs in community indicate that, there are the high levels of fungal contaminations in current used spices. Therefore, it is necessary to control the production units.

Keywords: Spices, Moulds, Tehran, Iran
COMMUNICATION WITH FAMILY MEMBERS OF PATIENTS IN THE INTENSIVE CARE UNIT; LESSONS FROM MULTIDISCIPLINARY FAMILY MEETINGS

Jinsoo Min, Guntae Park, Jisook Yoon, Jeong Yeon Shin, Sang Im Park, Young-jae Cho, Yeon Joo Lee

Seoul National University Bundang Hospital, Republic of Korea

Background/Purpose: Family meeting is the most studied communication intervention for intensive care unit (ICU) patients and their families in the Western countries. The interest of communication strategies is growing among the intensivists in South Korea. We report our experience of the multidisciplinary meetings with family members of ICU patient.

Methods: After regular seminars on communication and end-of-life care, consensus on guideline of the ICU family meeting was made. A weekly multidisciplinary meeting was held to review any issues on the ICU patients future plan. Eight family meetings were held between September 2014 and January 2015.

Results: The mean age and APACHE II score of the patients were 75.0 years and 33.8. The median duration of the family meeting was 23.1 minutes. Four patients had acute respiratory failure, 2 patients had septic shock, 1 patient had post-op acute respiratory distress syndrome, and 1 patient had ischemic encephalopathy. Except one family meeting, which failed to make decision, 7 family meetings were successfully conducted; 1 case of withdrawal of life-sustaining treatment (LST), 1 case of withholding of LST, 1 case of refusal to any LST, 2 cases of do-not-resuscitate, 1 case of full active treatment, and 1 case of supportive care. Four patients expired during hospital admission, 3 patients were discharged to long-term care facility, and 1 patient was discharged to home.

Conclusions: It is the first case series of the ICU multidisciplinary family meetings in South Korea. More evidences about the local cultures are required to understand to successfully integrate the family meeting into the ICU.

Keywords: End-of-life, Withdrawal, Withhold, Support
TRANSCULTURAL ADAPTATION AND VALIDATION OF FAMILIAL SATISFACTION IN THE INTENSIVE CARE UNIT IN KOREA: PRELIMINARY STUDY

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1Seoul National University Bundang Hospital, Republic of Korea, 2Seoul National University Hospital, Republic of Korea

Background/Purpose: Lately, in North America, questionnaires have been developed and validated, which were to assess family needs and satisfaction with care in the intensive care unit. One of the most widely used one is FS-ICU-24 survey. The purpose of this study is to prove the Korean version of FS-ICU-24 survey.

Methods: The study was performed in the medical, surgical, and emergency ICU of Seoul National University Bundang Hospital and Seoul National University Hospital. Relatives of all patients with a length of stay of 48 hours or longer were eligible for the study. And the validation included feasibility, construct validity, internal consistency, reliability and sensitivity. The survey consisted of 24 items and two categories: (i) satisfaction with care (14 items) and (ii) satisfaction with decision making (10 items).

Results: The translated form was distributed to 81 family members. The response rate was 61.7% and 97.9% of questions in returned forms were answered. Compared with a Visual Analogue Scale, the construct validity was good for the total survey satisfaction (Spearman p = 0.795). A Cronbach a coefficient for satisfaction with care subscale was 0.953; for satisfaction with decision making subscale was 0.886. The total FS-ICU-24 survey mean score was 78.48± 15.56. In this study, the responders were most satisfied with having adequate time to have their concerns addressed and questions answered (89.8±30.58) and least satisfied with the atmosphere of the ICU waiting room (41.46±36.91).

Conclusions: A cross-cultural adaptation of FS-ICU-24 into Korean version can be validated enough and will be acquired reliability.

Keywords: Familial satisfaction, Intensive care unit
PERIOPERATIVE RISK FACTORS FOR IN-HOSPITAL MORTALITY AFTER EMERGENCY GASTROINTESTINAL SURGERY

Jinyeong Lee, Seung Hwan Lee, Myung Jae Jung, Jae Gil Lee
Yonsei University College of Medicine, Republic of Korea

Background/Purpose: Several studies have analyzed the risk factors for mortality in elective abdominal surgery; however, few studies have evaluated the risk factors for in-hospital mortality in critically ill surgical patients undergoing emergency gastrointestinal (GI) surgery. Thus, the aim of this study was to identify risk factors associated with in-hospital mortality in critically ill surgical patients after emergency GI surgery.

Methods: The medical records of 362 critically ill surgical patients who underwent emergency GI surgery, admitted between January 2007 and December 2011, were reviewed retrospectively. Patients were divided into two groups: survivors (n = 307) and non-survivors (n = 55). Perioperative biochemical and clinical parameters were compared between the two groups. Logistic regression multivariate analysis was performed to determine the independent risk factors of in-hospital mortality.

Results: In-hospital mortality rates were 15.2%. Multivariate analyses identified cancer-related perforation (odds ratio [OR] 7.23; 95% confidence interval [CI] 1.61-32.57; P = 0.010), preoperative anemia (hemoglobin < 10 g/dL; OR, 8.54; 95% CI, 1.84-39.62; P = 0.006), and positive intraoperative peritoneal fluid culture (OR, 6.63; 95% CI, 1.04-42.43; P = 0.046) as independent risk factors for in-hospital mortality after emergency GI surgery.

Conclusions: In a population of critically ill surgical patients undergoing emergency GI surgery, cancer-related perforation, preoperative anemia (hemoglobin < 10 g/dL), and positive intraoperative peritoneal fluid culture were risk factors associated with in-hospital mortality. If these risk factors are recognized, a safer surgical option and meticulous postoperative care should be considered to reduce the risk of in-hospital mortality.

Keywords: Emergency surgery, Mortality, Critically ill
DESPITE THE STOPPING ASPIRIN FOR MORE THAN 7 DAYS, RISK FACTORS OF PROLONGED PFA-100 VALUE

Hyo-sung Bae, Dong-jun Kim, Dong-won Jo, Ki-tae Jung, Byung-sik Yu
Chosun University Hospital, Republic of Korea

Background/Purpose: Even if stopping aspirin for more than 7 days, researchers had seen that often prolonged Collagen/Epinephrine Closure time from experience. However, despite the stopping aspirin for more than 7 days, little is known about the risk factor of prolonged C/Epi CT.

Methods: 528 patients, taking antiplatelet agent and underwent elective surgery, were analyzed retrospectively. (1) Stopping period of aspirin, clopidogrel, cilostazol between the two groups in accordance with gender, age, hematocrit, platelet count, body mass index, C/Epinephrine CT, C/ADP CT differences test was used for independent T test. (2) In the group of stopping aspirin for more than 7 days, the relationships between the prolonged C/Epi CT and measured variables was analyzed by Pearsons chi-squared test. (3) In stopping period of aspirin in accordance with C/Epi CT, the sensitivity and specificity were measured by the ROC curve.

Results: (1) There was a significant correlation only stopping period of aspirin and C/Epi CT. (2) In group discontinued aspirin for more than 7 days, risk factors of prolonged C/Epi CT were female and blood type O. (3) AUC value was 0.605, in the case of aspirin stopping period was 4.5 days, the sensitivity was 83.6% and the specificity was 33.5%.

Conclusions: In group of stopping aspirin for more than 7 days, risk factors of prolonged C/Epi CT were female and blood type O. Women had the probability of prolonged C/Epi CT 1.769 times higher than men. And blood type O had a probability of prolonged C/Epi CT 1.995 times higher than the other blood types.

Keywords: Platelet function test, PFA-100, Aspirin, Risk factor
TRANSFUSION RISK SCORING MODEL AND BLOOD TRANSFUSION IN PERIOPERATIVE INTENSIVE CARE IN CARDIAC SURGERY

Tae Sik Kim, Ho Sung Son, Jae Seung Jung, Hee Jung Kim, Kyung Sun, Man Jong Baek, Seu In Choi

Korea University Medical Center, Republic of Korea

Background/Purpose: Cardiac surgery has a high hemorrhagic component, and large volume of blood transfusion is not rare in perioperative intensive care. Transfusion risk understanding scoring tool (TRUST) is a clinical tool for predicting the need for perioperative blood transfusion in cardiac surgery. However, it is not well known about the correlation between degree of score and transfusion volume. We evaluated whether high TRUST score could predict large volume of blood transfusion or not in perioperative intensive care after cardiac surgery.

Methods: We retrospectively collected data from consecutive adult patients underwent cardiac surgery at our institution from January 2011 to July 2014. Excluded patients were off-pump cardiac surgery patients, heart transplantation patients, and perioperative mechanical assist device patients. More or 5 units of red blood cells were considered as large volume of blood transfusion.

Results: The study included 314 patients. Thirteen percent of patients underwent other type of procedures, including combined coronary bypass grafting and valve surgery, and aortic surgery. Mean TRUST score was 2.7 ± 1.4. Ninety-two patients (29.3%) had the TRUST score of more or 4, predicting the probability of blood transfusion of more than 80%. The high TRUST score was related with large volume of red blood cell transfusion during the perioperative period (odds ratio, 3.640; p < 0.001).

Conclusions: High score of transfusion risk understanding scoring tool in cardiac surgery can predict large volume of blood transfusion in perioperative intensive care.

Keywords: Transfusion, Red blood cell, Cardiac surgery, Intensive care
PERIOPERATIVE RISK FACTORS ASSOCIATED WITH PRESSURE ULCERS AFTER MAJOR SURGERY

Hayeon Kim, Jeong Min Kim, Sungwon Na
Yonsei University College of Medicine, Republic of Korea

Background/Purpose: Postoperative pressure ulcers are important quality indicators of perioperative care, and their presence is associated with clinical outcomes and medical cost. This study aimed to identify the risk factors and clinical impact of pressure ulcers after surgery.

Methods: In this retrospective case-control study, 43 of 2498 patients who underwent major surgery were identified as having newly developed pressure ulcer, and the control group was matched for age, sex, surgery, and comorbidities.

Results: Baseline hemoglobin and albumin were lower in the pressure ulcer group than the control group. Lactate, blood loss, and amount of packed red blood cell (pRBC) transfusion were higher in the pressure ulcer group. Univariate analysis revealed that preoperative hemoglobin, albumin, lactate, intraoperative blood loss, amount of pRBC transfusion, APACHE score, Braden scale, postoperative ventilator care, and restraint were associated with pressure ulcer. In multiple logistic regression analysis, preoperative low albumin (odds ratio [OR] 0.2, 95% confidence interval [CI] 0.05-0.82, p < 0.05) and high lactate (OR 1.7, 95% CI 1.07-2.71, p < 0.05) were independently related to pressure ulcer. We constructed a clinical predictive model for postoperative pressure ulcer using these newly identified risk factors along with 3 previously identified risk factors (amount of pRBC transfusion, postoperative ventilator care, and Braden scale), which showed good predictability of pressure ulcers (area under receiver operating characteristic curve = 0.88).

Conclusions: Preoperative hypoalbuminemia and hyperlactemia were associated with the occurrence of pressure ulcer after major surgery.

Keywords: Pressure ulcers, Risk factors, Perioperative care

<table>
<thead>
<tr>
<th>Table 1: Predictive power of selected variables for pressure ulcer according to logistic regression analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Univariate analysis</strong></td>
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<tr>
<td>------------------------</td>
</tr>
<tr>
<td><strong>Odds ratio (95% CI)</strong></td>
</tr>
<tr>
<td>Preop Hb</td>
</tr>
<tr>
<td>Preop Alb</td>
</tr>
<tr>
<td>Preop lactate</td>
</tr>
<tr>
<td>Intraop bleeding</td>
</tr>
<tr>
<td>Intraop pRBC transfusion</td>
</tr>
<tr>
<td>APACHE score</td>
</tr>
<tr>
<td>Braden scale</td>
</tr>
<tr>
<td>Ventilator care</td>
</tr>
<tr>
<td>Restraint</td>
</tr>
</tbody>
</table>

Values are Odds ratio (95% CI). Preop Hb, preoperative hemoglobin; Preop Alb, preoperative albumin; Preop lactate, preoperative lactate; Intraop bleeding, intraoperative blood loss; APACHE score, Acute Physiology and Chronic Health Evaluation II score; ventilator care, postoperative ventilator care, restraint, physical restraint use in intensive care unit. *, p < 0.05 versus the control group.
<Figure 1>
CONTINUOUS MEASUREMENT OF FORCES DURING TRACHEAL INTUBATION BY USING MACINTOSH OR AIRWAY SCOPE LARYNGOSCOPES WITH A SPECIAL HANDMADE SENSOR

Kazuki Kurihara¹, Noriko Yokoo², Yu Onodera³, Hiroto Suzuki³, Masayuki Okada⁴, Masaki Nakane³, Kaneyuki Kawamae⁴

¹Department of Anesthesiology, Nihonkai General Hospital, Japan, ²Department of Anesthesiology, Yamagata Prefectural Kahoku Hospital, Japan, ³Department of Intensive Care Medicine, Yamagata University Faculty Of Medicine, Japan, ⁴Department of Anesthesiology, Yamagata University Faculty of Medicine, Japan

Background/Purpose: Only few reports have been published about continuous measurement of forces applied to soft tissues of the upper airway during laryngoscopy. We measured the force over time by using a special handmade sensor attached to the blade of each laryngoscope.

Methods: Twenty adult patients who required general anesthesia and tracheal intubation were included in the study. After anesthesia induction with neuromuscular blockade, laryngoscopy and tracheal intubation were performed by using a Macintosh or Airway Scope laryngoscope (Pentax, Tokyo, Japan) in the assigned randomized sequence. Then, we measured the force applied to the base of the tongue continuously. Changes in hemodynamics (heart rate and blood pressure) during laryngoscopy and tracheal intubation were also measured. In all the patients, we investigated findings of pharyngodynia, odynophagia, and hoarseness after surgery.

Results: With the Airway Scope, the median [IQR] maximal and impulse forces were lower than those with the Macintosh (0.43 kgf [0.28-0.71 kgf] vs 1.44 kgf [1.17-2.17 kgf], p = 0.001 and 3.85 kgf [0.6-7.9 kgf] vs 12.85 kgf [9.75-16.5 kgf], p = 0.026, respectively). No significant differences in hemodynamic changes were observed between the Macintosh and Airway Scope. The severity of postoperative pharyngodynia, odynophagia, and hoarseness did not significantly differ between the scopes.

Conclusions: This study suggests that the force applied to the base of the tongue during laryngoscopy was less with the Airway Scope laryngoscope than with the Macintosh laryngoscope. However, the difference in force did not affect the hemodynamic responses and occurrence of postoperative sore throat.

Keywords: Force, Impulse force, Laryngoscopy, Macintosh laryngoscope
EFFECT OF SODIUM BICARBONATE ON PREVENTION OF ACUTE KIDNEY INJURY IN HIGH RISK PATIENTS UNDERGOING OFF-PUMP CORONARY ARTERY BYPASS

Jong Wook Song, Jae-kwang Shim, Young Lan Kwak
Yonsei University College of Medicine, Republic of Korea

Background/Purpose: Despite avoiding cardiopulmonary bypass, acute kidney injury (AKI) remains to be a frequent complication after off-pump coronary artery bypass (OPCAB). Sodium bicarbonate may reduce renal injury by alkalinizing tubular urine and scavenging oxygen free radical species. We investigated whether the perioperative infusion of sodium bicarbonate could prevent AKI in patients with known risk factors of AKI undergoing OPCAB.

Methods: A total of 158 patients with one or more of the following risk factors of AKI were included; 1) chronic kidney disease 2) left ventricular ejection fraction <35% or congestive heart failure 3) age >70 years 4) diabetes 5) emergency or re-operation. Patients were randomly allocated to receive either sodium bicarbonate (0.05 mmol/kg over 1 hour after induction followed by an infusion at 0.15 mmol/kg/h for 23 h, bicarbonate group) or normal saline (control group). The incidence of AKI according to the definition of Acute Kidney Injury Network, fluid balance, amount of blood loss and transfusion requirement during operation and postoperative 48 h were assessed.

Results: The incidence of AKI was 27.5% (22/80) and 21.8% (17/78) in the control and the bicarbonate group, respectively (P=0.406). The serum concentrations of creatinine measured preoperatively and at postoperative 24 h and 48 h were similar between the groups. There were no significant differences in fluid balance including the amount of blood loss and transfusion requirement during operation and postoperative 48 h between the groups.

Conclusions: Perioperative administration of sodium bicarbonate did not reduce the incidence of AKI in patients at high risk of developing AKI following OPCAB.

Keywords: Acute kidney injury, Off-pump coronary artery bypass
WARFARIN THERAPY AND PERIOPERATIVE TRANSFUSION REQUIREMENT WITH BLEEDING AMOUNT IN PATIENTS UNDERGOING CARDIAC SURGERY WITH CARDIOPULMONARY BYPASS: A RETROSPECTIVE STUDY

Chung-sik Oh, Woon-seok Kang, Seong-hyop Kim
Konkuk University Medical Center, Republic of Korea

Background/Purpose: Issue of warfarin therapy effect on perioperative transfusion requirement and postoperative bleeding amount was open to dispute in previous studies. The study was designed to evaluate the effect of warfarin on perioperative transfusion requirement, postoperative bleeding amount and coagulation status in patients with atrial fibrillation (AF) undergoing cardiac surgery with cardiopulmonary bypass (CPB).

Methods: Medical records from 107 consecutive patients with AF on warfarin therapy undergoing cardiac surgery with CPB from 2008 to 2013 at single university teaching hospital were retrospectively reviewed to compare the patients on to those not on warfarin therapy in terms of perioperative transfusion requirement, postoperative 24 hour bleeding amount, and coagulation status assessment using prothrombin time (PT) with international normalized ratio (INR) and rotational thromboelastometry (ROTEM).

Results: Although PT with INR was significantly prolonged both before and after surgery in patients on warfarin therapy, ROTEM data, perioperative transfusion requirement and postoperative 24 hour bleeding amount (785 ± 331 ml versus 676 ± 303 ml, P = 0.089, respectively) were not significantly different between the patients on and those not on warfarin therapy.

Conclusions: In patients with AF on warfarin therapy undergoing cardiac surgery with CPB, warfarin therapy did not significantly increase perioperative transfusion requirement and postoperative bleeding amount, which appeared more reliably reflected by coagulation status assessed by ROTEM than by PT with INR.

Keywords: Warfarin, Blood transfusion, Thromboelastometry
Table 2. Number of patients required perioperative transfusion and postoperative 24 hour bleeding amount

<table>
<thead>
<tr>
<th>Transfusion requirement</th>
<th>24 hours postoperative period</th>
<th>Intraoperative period</th>
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<tbody>
<tr>
<td></td>
<td>On warfarin (N = 66)</td>
<td>Not on warfarin (N = 41)</td>
</tr>
<tr>
<td>pRBC (units) ≤ 2</td>
<td>50 (64%)</td>
<td>28 (36%)</td>
</tr>
<tr>
<td></td>
<td>&gt; 2</td>
<td>16 (55%)</td>
</tr>
<tr>
<td>FFP (units) ≤ 2</td>
<td>42 (59%)</td>
<td>29 (41%)</td>
</tr>
<tr>
<td></td>
<td>&gt; 2</td>
<td>24 (67%)</td>
</tr>
<tr>
<td>PC (units) ≤ 8</td>
<td>59 (61%)</td>
<td>38 (39%)</td>
</tr>
<tr>
<td></td>
<td>&gt; 8</td>
<td>7 (70%)</td>
</tr>
<tr>
<td>Cryoprecipitate (units)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≤ 10</td>
<td>64 (61%)</td>
<td>40 (39%)</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>2 (67%)</td>
<td>1 (33%)</td>
</tr>
<tr>
<td>Bleeding amount (ml)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Data are expressed as number of patients (percentage) and mean ± standard deviation.

Abbreviations: pRBC, packed red blood cell; FFP, fresh frozen plasma; PC, platelet concentrate; Bleeding amount refers to amount of blood collected from chest tube drain bottle in ICU during postoperative 24 hours.

Table 3. Preoperative and postoperative haematological, coagulation and rotational thromboelastometric data

<table>
<thead>
<tr>
<th>Haematological data</th>
<th>Before surgery</th>
<th>After surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin (g.dl⁻¹)</td>
<td>13.7 ± 1.6</td>
<td>13.4 ± 2.0</td>
</tr>
<tr>
<td>Hb (g%)</td>
<td>41 ± 4</td>
<td>40 ± 5</td>
</tr>
</tbody>
</table>

Coagulation data

| PT (s) | 17 ± 3 | 14.1 ± 1² |
| INR    | 1.36 ± 0.27 | 1.06 ± 0.12² |
| aPTT (s) | 43 ± 8   | 38 ± 6²   |
| Platelet x 10⁹ (comt) µl⁻¹ | 199 ± 60 | 212 ± 61 |

ROTEm data

| CT (sec) | 173 ± 40 | 176 ± 26 |
| CFT (sec) | 90 ± 34  | 82 ± 23  |
| MCF (mm)  | 59 ± 7   | 60 ± 5   |
| ML (%)    | 14 ± 5   | 14 ± 5   |

Data are expressed as mean ± standard deviation.

Abbreviations: PT, prothrombin time (normal range: 11.9 to 14.5 sec); INR, international normalized ratio (normal range: 0.87 to 1.2); aPTT, activated partial thromboplastin time (normal range: 29 to 45 sec); ROTEm, rotational thromboelastometry; Before surgery of haematologic and coagulation data refers immediate before surgery; Before surgery of ROTEm data refers immediately after anaesthesia induction; After surgery refers immediately after postoperative ICU admission.

²P < 0.05 compared with group on warfarin.
**DOES CLINICAL PARAMETERS CAN PREDICT THE HIGH RISK OF MULTIDRUG RESISTANCE DEVELOPMENT IN SECONDARY PERITONITIS PATIENTS?**

**: 5-YEARS RETROSPECTIVE COHORT STUDY IN A SINGLE CENTER**

Myung Jae Jung, Seung Hwan Lee, Hyung Won Kim, Tae Hwa Hong, Kyung Won Lee, Jae Gil Lee

Yonsei University Health System, Republic of Korea

**Background/Purpose:** The aim of this study is to evaluate the predictive value of pre-operative clinical parameters for the increased risk of multi-drug resistance (MDR) development in secondary peritonitis patients who underwent surgery.

**Methods:** From January 2007 to December 2011, 519 consecutive patients underwent surgery due to secondary peritonitis in Yonsei University Severance Hospital. Among them 410 patients were finally enrolled, medical records of demographics, clinical parameters, microbiologic results and the route of infection were retrospectively reviewed. We compared these variables by two groups; MDR positive and negative group.

**Results:** MDR has developed in 40 patients (9.8%) during perioperative period. Patient demographics showed no difference between two groups. Sites of injured bowel (stomach, duodenum, small bowel and colo-rectum), and mechanism of injury (ulceration, ischemia, cancer, obstructive, traumatic, intervention) did not showed difference between two groups. (p=0.467, p=0.290) All the Clinico-laboratory findings, as shock, fever, tachycardia and leukocytosis, anemia, Lactate, base excess showed no difference. And the patient’s underlying comorbidities; cardiopulmonary, endocrine, renal, malignant, immunsuppressive disease did not increase the risk of MDR. (p=0.245, 0.813, 0.593, 0.510 and 0.710) Only the route of secondary peritonitis showed difference between two groups (Community acquired vs Health-care infection; 14.5% vs 7.4%, p=0.023). MDR positive group showed higher ICU and hospital stay days (3.2 vs 10.5 days, p<0.001 and 23.6 vs 58.2 days, p<0.001) with higher perioperative mortality rate. (8.6% vs 25.0%, p=0.004)

**Conclusions:** Preoperative clinical conditions of secondary peritonitis patients cannot predict the higher risk of MDR development during perioperative period.

Keywords: Multi-drug resistance, Secondary peritonitis
THE USEFULNESS OF A CLASSIFICATION AND REGRESSION TREE ALGORITHM FOR DETECTING PERIOPERATIVE TRANSFUSION-RELATED PULMONARY COMPLICATIONS

Kyu Nam Kim, Dong Won Kim, Mi Ae Jeong, Soo Yeon Kim
Hanyang University Seoul Hospital, Republic of Korea

Background/Purpose: Transfusion-related acute lung injury (TRALI) and transfusion-associated circulatory overload (TACO) are leading causes of transfusion-related mortality. Clifford et al. developed an electronic medical record-based screening classification and regression tree (CART) algorithm for predicting transfusion-related pulmonary complications. In the Republic of Korea, TRALI is not sufficiently recognized and an accurate TRALI incidence has not been reported. Therefore, we carried out this study to assess the incidence of TRALI and to determine whether the CART algorithm can be applied to our hospital data.

Methods: 11,422 patients whose age were over 6 months and who underwent general or regional anesthesia, a retrospective analysis of 1948 patients who received blood transfusion was done. After the patients were diagnosed by the relevant diagnostic criteria, they were re-classified by the CART algorithm. The validity of the algorithm was evaluated with sensitivity, specificity, likelihood ratios, and misclassification rate.

Results: Among 1948 patients who had received 11,269 units of transfusion, 26 TRALI and 20 TACO were identified. The incidence of TRALI among the transfused patients was 1.33%, and per unit of transfused blood product was 0.23%. The sensitivity and specificity of the TRALI algorithm were estimated to be 73.1% (95% confidence interval (CI), 53.9%-86.3%) and 57.0% (95% CI, 52.5%-61.4%). For TACO, the sensitivity and specificity were 90.0% (95% CI, 69.9%-97.2%) and 56.0% (95% CI, 51.6%-60.4%), respectively.

Conclusions: Low specificity of the CART algorithm adopted by Clifford et al indicated its limited diagnostic value in the Republic of Korea. A new algorithm is needed to facilitate the detection of transfusion-related complications.

Keywords: Transfusion-related acute lung injury, Transfusion-associated circulatory overload, Classification and regression tree
LONG DURATIONS OF FASTING AND MASSIVE DIARRHEA ARE ASSOCIATED WITH ELEVATIONS IN SERUM VANCOMYCIN CONCENTRATIONS DURING ENTERAL ADMINISTRATION IN CRITICALLY ILL PATIENTS: A RETROSPECTIVE OBSERVATIONAL

Takehiko Oami¹, Noriyuki Hattori¹, Yosuke Matsumura¹, Eizo Watanabe¹, Ryuzo Abe¹, Taku Oshima¹, Waka Takahashi¹, Shingo Yamazaki², Tatsuya Suzuki², Shigeto Oda¹

¹Department of Emergency and Critical Care Medicine, Chiba University Graduate School of Medicine, Japan, ²Department of Emergency and Critical Care Medicine, Chiba University Graduate School of Medicine, Japan

Background/Purpose: Serum vancomycin (VCM) concentration is assumed to be unaffected by the oral or enteral administration, since VCM is not absorbed through healthy intestinal mucosa. However, elevations in the serum VCM concentrations have been reported in some cases, suggesting that therapeutic drug monitoring is needed.

Methods: In this retrospective study, we enrolled 19 patients admitted to our intensive care unit who were treated with enteral VCM from December 2006 to January 2014. Clinical factors were compared between two groups: Group E whose serum concentrations were detectable, and Group N whose concentrations were below the detection limit of the VCM assay.

Results: Group E comprises seven patients and group N comprises twelve patients. The fasting duration in Group E was significantly longer compared with that in Group N (17 vs. 8 days, p = 0.023). Furthermore, there was a significant correlation between the serum VCM concentrations and the fasting duration (r=0.79, p<0.0001), and the amount of diarrhea (r=0.46, p=0.046). There was a trend toward higher Sequential Organ Failure Assessment (SOFA) subscore for the kidney system in Group E at the time of therapeutic drug monitoring without significant difference (Group E; 4.0 vs. Group N; 1.5, p=0.068).

Conclusions: Long durations of fasting and massive diarrhea were associated with elevations in the serum VCM concentrations, which suggested that TDM might be necessary during enteral VCM administration in critically ill patients.

Keywords: Vancomycin, Enteral administration, Therapeutic drug monitoring
PHARMACOTHERAPEUTIC PROBLEMS AND PHARMACIST INTERVENTIONS IN A MEDICAL INTENSIVE CARE UNIT IN KOREA

Tae Yun Park, Sang-min Lee, Sung Eun Kim, Ka-eun Yoo, Go Wun Choi, Yun Hee Jo, Yoonsook Cho, Hyeon Joo Hahn, Jinwoo Lee, A Jeong Kim

Seoul National University Hospital, Republic of Korea

Background/Purpose: Interest in pharmacists participating in the multidisciplinary intensive care team is increasing. However, studies examining pharmacist interventions in the medical intensive care unit (MICU) are limited in Korea. The aim of this study was to describe the current status of pharmacist interventions and to identify common pharmacologic problems requiring pharmacist intervention in the MICU.

Methods: Between September 2013 and August 2014, a retrospective, observational study was conducted in the 22-bed MICU at Seoul National University Hospital. Data were obtained by trained pharmacists who participated in MICU rounds three times a week. In addition to patient characteristics, data on the cause, type, related drug, and acceptance rate of interventions were collected.

Results: In 340 patients, a total of 1211 pharmacologic interventions were performed. The majority of pharmacologic interventions were suggested by pharmacists at multidisciplinary rounds in the MICU. The most common pharmacologic interventions were adjustment of dosage and administration (n = 328, 26.0%), followed by parenteral nutrition (PN)/enteral nutrition (EN) support (n = 228, 18.1%), the provision of drug information (n = 228, 18.1%), and advice about pharmacokinetics (n = 118, 9.3%). Antimicrobial agents (n = 516, 42.6%) were most frequent type of drug associated with pharmacist interventions. The acceptance rate of interventions was 84.1%, with most accepted by physicians within 24 hours (n = 602, 92.8%).

Conclusions: Medication and nutritional problems are frequently encountered pharmacotherapeutic problems in the MICU. Pharmacist interventions play an important role in the management of these problems.

Keywords: Intensive care unit, Intervention, Pharmacist
AEROSOL COLISTIN TREATMENT IN INTENSIVE CARE UNIT (ICU)

Miseon Park¹, Seungyong Park¹, Jinseon Bum¹, Hyocho Ahn¹, Jusin Kim¹, Hyunsun Kim¹, Chiryang Chung², Dongchan Kim¹, Heungbum Lee¹

¹Chonbuk National University Hospital, Republic of Korea, ²Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Recently ventilator-associated pneumonia (VAP) caused by multi-drug resistant (MDR) gram-negative bacteria has been increasing and resulting in significant morbidity and mortality. Colistin is active against gram-negative bacteria, including the MDR gram-negative bacteria. However, intravenous administration of colistin was abandoned because of its nephrotoxicity and neurotoxicity, and it was a controversial problem whether inhaled colistin is effective or not. We conducted the present study to assess the effectiveness and safety of aerosolized colistin for the treatment of pneumonia by MDR gram-negative pathogens.

Methods: From February 2012 to March 2014, we retrospectively reviewed the medical records of patients who received aerosol colistin treatment due to VAP by MDR in ICU of Chonbuk National University Hospital.

Results: Total 27 patients were analyzed and the patients were divided the normal renal function group (n=16) and the acute kidney injury group (n=11). The ICU stay and mortality did not show any difference between the groups. And there was no significant difference in the results of the daily mean dose of aerosol colistin, mean total cumulative dose, and mean administration period. The incidence of nephrotoxicity significantly increased with the number of used concomitant medications that have nephrotoxicity (p=0.009). Especially, the use of vancomycin and aminoglycoside showed a trend of nephrotoxicity between the groups (p=0.072 and p=0.084).

Conclusions: Aerosolized colistin appears to be relatively safe and effective option for the treatment of VAP by MDR pathogens. and the concomitant use of nephrotoxic drugs might be the one of the important factors in developing the AKI.

Keywords: Inhaled colistin, Multi-drug resistant pathogen, Ventilator-associated pneumonia
FACTORS INFLUENCING MORTALITY IN PULMONARY TUBERCULOSIS WITH ACUTE RESPIRATORY FAILURE IN MEDICAL INTENSIVE CARE UNIT, SONGKLANAGARIND HOSPITAL, SOUTHERN THAILAND: A 10-YEAR RETROSPECTIVE STUDY

Rungsun Bhurayanontachai
Division of Critical Care Medicine, Department of Internal Medicine, Faculty of Medicine, Prince of Songkla University, Thailand

Background/Purpose: Pulmonary tuberculosis is a common pulmonary infection in Thailand. Despite the aggressive prevention and treatment, the incidence and its consequences remain high. Acute respiratory failure is the fatal complication from pulmonary tuberculosis, causing burden in intensive medical care and lead to mortality. This retrospective study was conducted to describe the clinical characteristics and to indicate the factors influencing mortality in patient with pulmonary tuberculosis with acute respiratory failure.

Methods: All medical records of the patients with pulmonary tuberculosis requiring mechanical ventilator support from 2002 to 2012 were reviewed. Demographic data, clinical presentation, radiographic finding, biochemical tests and clinical outcome were collected. Those data were compared by independent t-test and chi-square test between survivors and non-survivors. A regression analysis was performed to identify the factors influencing mortality in medical intensive care unit.

Results: Of 134 patients reviewed, the mortality rate was 54% (73/134). In univariate analysis, the non-survivors had female gender, underlying of liver cirrhosis, lower serum albumin, and present of consolidation on chest radiography (Table 1). Eventually, gender, serum albumin and a presence of consolidation on chest roentgenogram were only independent factors for mortality in pulmonary tuberculosis with acute respiratory failure (Table 2).

Conclusions: The mortality of patients with pulmonary tuberculosis requiring mechanical ventilator support was high. Gender, serum albumin level and the consolidation pattern of chest roentgenogram were the influencing factors of mortality in this group.

Keywords: Pulmonary tuberculosis, Acute respiratory failure

<table>
<thead>
<tr>
<th>Table 1 Clinical characteristic of survivor and non-survivor</th>
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<tbody>
<tr>
<td><strong>Survivor (n = 61)</strong></td>
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<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Age, mean(SE), y</td>
</tr>
<tr>
<td>Male sex, N (%)</td>
</tr>
<tr>
<td>Comorbidities, N (%)</td>
</tr>
<tr>
<td>- acute kidney injury, N (%)</td>
</tr>
<tr>
<td>- AIDS, N (%)</td>
</tr>
<tr>
<td>- Cancer, N (%)</td>
</tr>
<tr>
<td>- Chronic lung disease, N (%)</td>
</tr>
<tr>
<td>- Type 2 DM, N (%)</td>
</tr>
<tr>
<td>- Cirrhosis, N (%)</td>
</tr>
<tr>
<td>- Old pulmonary TB, N (%)</td>
</tr>
<tr>
<td>- Immunosuppressive agent, N (%)</td>
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<table>
<thead>
<tr>
<th>Clinical Presentation</th>
</tr>
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<tbody>
<tr>
<td>Fever, N (%)</td>
</tr>
<tr>
<td>Productive cough, N (%)</td>
</tr>
<tr>
<td>Weight loss, N (%)</td>
</tr>
<tr>
<td>Dyspnea, N (%)</td>
</tr>
<tr>
<td>Anemia, N (%)</td>
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<table>
<thead>
<tr>
<th>Chest x-rays finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary nodules, N (%)</td>
</tr>
<tr>
<td>Interstitial infiltrate, N (%)</td>
</tr>
<tr>
<td>Gastrointestinal lesion, N (%)</td>
</tr>
<tr>
<td>Miliary consolidation, N (%)</td>
</tr>
<tr>
<td>Quadran of lung injury</td>
</tr>
<tr>
<td>- 1st to 4th quadrant, N (%)</td>
</tr>
<tr>
<td>- 3 to 4 quadrant, N (%)</td>
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<table>
<thead>
<tr>
<th>Acute lung injury index, mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>236 (73)</td>
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<thead>
<tr>
<th>Laboratory</th>
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<tr>
<td>- Hematocrit, mean (SD), %</td>
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<td>- Neutrophil, mean(SD), cell/mm³</td>
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<td>- Creatinine, mean (SD), mg/dL</td>
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<td>- Albumin, mean (SD), g/dL</td>
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<th>Table 2 Independent factors of mortality in pulmonary tuberculosis with acute respiratory failure</th>
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<td><strong>Odd ratio</strong></td>
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<tr>
<td>Gender</td>
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<td>Consolidation</td>
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<td>Serum albumin</td>
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THE TREND OF APPLYING LUNG PROTECTIVE STRATEGIES IN OPERATING ROOM: 10 YEARS OF OBSERVATIONAL STUDY IN SEVERANCE HOSPITAL

Woo Kyung Lee, Namo Kim, Jeongmin Kim, Sungwon Na

Yonsei University College of Medicine, Republic of Korea

Background/Purpose: Since the lung protective ventilation (Tidal volume 6ml/kg of ideal body weight) became a standard in acute respiratory distress syndrome (ARDS), the trend of apply mechanical ventilation is also changed. We assessed the evolution of mechanical ventilation strategies during general anesthesia and identified factors associated with the selection of a nonprotective ventilation strategy.

Methods: This retrospective study covered a 10-year period from March 2004 to December 2014. It included 353 adult patients who underwent general anesthesia in the operating room, and enrollment is now ongoing. We considered a tidal volume(TV) greater than 10ml/kg of ideal body weight (IBW) as not lung protective. We evaluated the use of non-protective ventilation strategies and the change anesthetic gas usage over time in men and women, by American Society of Anesthesiologists(ASA) classification. Moreover, the incidence of pulmonary complications in 2014 under protective versus non-protective ventilation will be assessed and compared.

Results: Over the 10 years, there was a significant reduction in the mean TV/IBW (ml/kg) applied to patients (10.03 vs. 8.16, p=.000). Also the ratio of patients receiving PEEP was increased in 2014 (42.99% vs. 0.41%) and male patients received more non-protective ventilation comparing to women (53.93% vs. 13.58%, p=0.000). The trend of anesthetic gas usage changed over 10 years from Sevoflurane, Desflurane, Enflurane and Isoflurane to Sevoflurane and Desflurane.

Conclusions: Although use of non-protective ventilation decreased, 8.41% of patients received a non-protective ventilation. And the usage of PEEP is still insufficient. More strategies to apply protective lung ventilation in operating room are needed.

Keywords: Tidal volume, Mechanical ventilation, Lung-protect strategy
REVIEW OF CASES PERFORMED HIGH FLOW OXYGEN THERAPY FROM CRICOTHYROTONMY TUBE

Keitaro Suzuki, Masahiro Shinozaki, Arito Kaji, Hiromasa Yakushiji, Motohiro Yamada
Kishiwada Tokushukai Hospital, Japan

Background/Purpose: A high flow oxygen therapy (HFOT) is a relatively new device for respiratory support. There are some characteristic about HFOT, for example, washout of nasopharyngeal dead space, the provision of warm and humidified gas to the airways, improvement of patient comfort and tolerance. Cricothyrotomy tubes (Mini-Trach II) are useful for control of sputum. We examined the effect of the combination of HFOT and Mini-Trach II.

Methods: We reviewed 8 patients conducted the combination of HFOT and Mini-Trach II between December 2012 and February 2014, and examined their age, sex, baseline diseases, duration, outcome and the reason for the introduction of this method. We defined cases which ended oxygen therapy as success, and the others as failure.

Results: 7 cases out of 8 cases was success, and 1 case was failure. This method was effective in cases as follows: upper airway stenosis, difficulty of sputum control, or insufficient ventilation because of much dead space.

Conclusions: We concluded that advantages and characteristics of HFOT and cricothyrotomy tubes are able to apply at the same time.

Keywords: High flow, Mini-Trach II, Upper airway stenosis
THE DISCORDANCE BETWEEN TWO SEVERITY SCORING SYSTEMS IN MEDICAL INTENSIVE CARE UNIT

Hyeran Kang, Youlim Kim, Gajin Lim, Yeonjoo Lee, Sejoong Kim, Jongsun Park, Hoil Yoon, Jae-ho Lee, Choon-taek Lee, Sang-hwan Do, Young-jae Cho

Seoul National University Bundang Hospital, Republic of Korea

Background/Purpose: The Acute Physiology and Chronic Health Evaluation (APACHE) II classification system and the Simplified Acute Physiology Score (SAPS) 3 are the scoring system used widely in the field of intensive care units (ICU) for predicting hospital mortality. The aim of this study was to compare the probability of death between APACHE II and SAPS 3 scoring systems.

Methods: This was a retrospective review of 560 patients admitted to ICU from October to December 2014 in the tertiary, teaching hospital. We compared the predictive mortality between APACHE II and SAPS 3 scores of all patients and death patients.

Results: The APACHE II score was not proportionate to SAPS 3 score. The predictive mortality of APACHE II is also not similar value of SAPS 3. The predictive mortality in the dead patients of APACHE II is mean 70.3%, while that of SAPS 3 is mean 52.8%. Moreover, the predictive mortalities of both systems did not correlate with real mortality of patients.

Conclusions: There are the discordance between APACHE II and SAPS 3 scoring system in critically ill patients who admitted to medical ICU. More predictable severity scoring systems still need to be developed for predicting ICU patient mortality.

Keywords: Acute physiology and chronic health evaluation II, Simplified acute physiology score 3
CLINICAL INTERPRETATION OF C-REACTIVE PROTEIN IN PATIENT WITH PNEUMONIA

Jungyoup Lee, Kyuseok Kim, You Hwan Jo, Jae Hyuk Lee, Joonghee Kim, Ji Eun Hwang, Chulmin Ha, Young Sang Ko

Seoul National University Bundang Hospital, Republic of Korea

Background/Purpose: There were little studies about clinical interpretation of C-reactive protein (CRP) value in patient with pneumonia. We investigated association of CRP and 30-day mortality in patients with pneumonia who were admitted to intensive care unit (ICU).

Methods: The patients with pneumonia who were admitted to ICU and had CRP values of three times within 48 hours were enrolled. We investigated the association of CRP and 30-day mortality. The dynamic changes of CRP values per hour were calculated. Area under the curve (AUC) was calculated to measure mortality predictability of CRP values. To find independent predictors for mortality, CRP and dynamic change of CRP was adjusted by APACHE II score.

Results: From February 2009 to January 2015, total of 258 patients were enrolled and analyzed retrospectively. Overall mortality was 27.5%. Median time (interquartile range) of second and third CRP values from admission was 17.7 hours (24.0-21.0) and 41.4 hours (37.6-44.8). High CRP values that were measured within 48 hours were significant to predict 30-day mortality; First CRP, adjusted odds ratio (AOR) 1.03 95% confidence interval (CI) 1.01-1.06; Second CRP, AOR 1.04 95% CI 1.01-1.07; Third CRP, AOR 1.05 95% CI 1.02-1.09. AUC (95% CI) of CRP values were flowing; first CRP, 0.60(0.52-0.67); second CRP, 0.51(0.43-0.60); third CRP, 0.51 (0.43-0.60). The dynamic changes of CRP (%/hour) were not significant.

Conclusions: High CRP within 48 hours was independent risk factor to predict 30-day mortality in patients with pneumonia who were admitted to ICU. The variation of CRP values was not associated with mortality.

Keywords: Pneumonia, Mortality, C-reactive protein
CHANGES IN THE MANAGEMENT OF THE TYPE 1 SPINAL MUSCULAR ATROPHY OVER 7 YEARS: EXPERIENCE AT A TERTIARY HOSPITAL IN KOREA

Yousun Kim, Bora Lee, Healin Oh, Jonghee Chae, Junedong Park, Dongin Suh
Seoul National University Hospital, Republic of Korea

Background/Purpose: Spinal muscular atrophy (SMA) type 1 is a devastating pediatric neuromuscular disease characterized by a perinatal distress, a gradual respiratory failure and early death. Rapid technological advances now enabled us to save them longer than we used to know. We aimed to assess recent changes in the management that applied to type 1 SMA children with regard not only to the respiratory care but also to other general aspects.

Methods: We retrospectively reviewed the electrical medical records of subjects confirmed with type 1 SMA who visited the Seoul National University Childrens Hospital between 2008 and 2014. Data on clinical characteristics, modalities of respiratory support, multi-disciplinary evaluations and clinical outcomes were descriptively analyzed and compared to previous reports.

Results: During the periods 37 children were confirmed as type 1 SMA. Typical patients had an onset of disease in the first 3 months with hypotonia, admitted to the hospital due to pneumonic episodes in the first 6 months. Then they started to have a respiratory support via tracheostomy or non-invasive positive pressure ventilation and changed from oral to tube feeding. Unless they had an accident they lived longer than 24 months. Respiratory devices trended to be applied earlier before they present distress with less invasive modalities. Consultations to multi-disciplinary team were done but the timings were widely variable.

Conclusions: Advances in the respiratory support enabled prolonged survival in children with type 1 SMA. Systematic approach and timely applied care should now be serviced with regard not only to the respiratory but also to the general aspects.

Keywords: Spinal muscular atrophy, Prolonged survival, Respiratory support
APPLICATION OF HEMODYNAMIC TESTING AND RAPID BIOCHEMICAL TESTS IN IDENTIFYING CAUSES OF DYSPNEA IN EMERGENCY DEPARTMENT

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The 1st Affiliated Hospital of He’nan University of Science and Technology, China

Background/Purpose: To investigate the applications of non-invasive hemodynamic detection combine with rapid biochemical tests in the diagnosis of acute dyspnea in emergency department.

Methods: 138 patients with dyspnea underwent non-invasive hemodynamic detection including systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), cardiac index (CI), cardiac output (CO), stroke volume (SV), stroke index (SI), thoracic fluid volume (TFC), and were detected the cardiac enzymes (CK, CK-MB), D-dimer (D-dimer), N terminal pro-brain natriuretic peptide (NT-BNP) simultaneously.

Results: Compared with the patients without dyspnea, 1. CI, CO, SV, SI of the patients with dyspnea were lower than those without dyspnea (P<0.05), SBP, DBP, HR, CK CK-MB D-Dimer NT-BNP of patients with dyspnea were higher than those without dyspnea (P<0.05). 2. CI CO SV SI of the patients with Cardiogenic dyspnea were lower (P<0.05) and ck ck-mb D-dimer, NT-BNP were higher than pulmonary dyspnea (P<0.05), there were no statistically differences in SBP, DBP, HR (P>0.05).

Conclusions: Non-invasive hemodynamic joint rapid biochemical tests may provide the basis for the identification and treatment for acute dyspnea.

Keywords: Non-invasive, Hemodynamic, Detection, Dyspnea
BEDSIDE SONOGRAPHIC DIAGNOSIS OF ACUTE BRONCHIOLITIS IN PEDIATRIC PATIENTS

Chia-wan Tang¹, Kai-sheng Hsieh²
¹Kaoshiung Veteran’s General Hospital, An-Tai Hospital, Taiwan, ²Kaohsiung Chang Gung Memorial Hospital, Taiwan

Background/Purpose: Approximately 10,000 children <1 yr old are hospitalized annually in the United States due to RSV infection. Conventionally, radiographic imaging is used for clinical examination. Significant advances in sonography have made it a useful tool for the diagnosis of pulmonary pathology. To date, no information is available for real-time dynamic chest sonography. Therefore we employed portable ultrasonography as a non-invasive method and an alternative tool for the bedside diagnosis of acute bronchiolitis. Approximately 10,000 children <1 yr old are hospitalized annually in the United States due to RSV infection. Conventionally, radiographic imaging is used for clinical examination. Significant advances in sonography have made it a useful tool for the diagnosis of pulmonary pathology. To date, very little information is available for real-time dynamic chest sonography in patients with acute bronchiolitis. Therefore we employed portable ultrasonography as a non-invasive method and an alternative tool for the bedside diagnosis of acute bronchiolitis.

Methods: This study was conducted in pediatric ward in a tertially-teaching hospital. Chest sonography was performed by 2 of the authors (CWT and KSH). Chest sonography was interpreted independent of the radiographic findings. We enrolled 15 inpatients that were found to have acute bronchiolitis. All of them had chest radiography for the confirmation of diagnosis. Sonographic signs of patients with acute bronchiolitis were compared with controls (n=30).

Results: A total of 45 children, 15 with acute bronchiolitis and 30 without bronchiolitis as control group were examined. From the sonographic images, we specifically noted three sonographic signs: lung sliding sign, airbronchogram sign and change of B line sign whereas normal lung sliding sign had sensitivity of 80% and specificity of 1.6%, Airbronchogram sign had sensitivity of 86% and specificity of 83%. Lost of B line sign had a sensitivity of 96% and specificity of 67%.

Conclusions: Our results demonstrated that in experienced hands and use the combination of normal sliding sign, loss of B line sign and airbronchogram signs, sonography may be considered a tool of choice for the diagnosis of patients with acute bronchiolitis.

Keywords: Lung ultrasound, Acute bronchiolitis, Children
IMPACT OF PREVIOUS USE OF TOBACCO, ALCOHOL OR PSYCHOTROPIC DRUG ON SEDATION IN ICU

Soo Jung Kim, Jin Woo Lee, Sang-min Lee
Seoul National University Hospital, Republic of Korea

Background/Purpose: Previous use of tobacco, alcohol or psychotropic could affect sedation in critically ill patients. However, the use of tobacco, alcohol or psychotropic drugs in patients admitted to the MICU in Korea has not been well evaluated. The objective of the study was to evaluate previous use of tobacco, alcohol, or psychotropic drug and their impact on sedation in MICU patients.

Methods: We conducted a single-center prospective observational pilot study in MICU from February through March 2015. Data on the history of smoke, alcoholism, or psychotropic drug were collected, along with sedation levels which were assessed every 6 hours using the Richmond Agitation-Sedation Scale. Information on sedative use during the initial 7 days of ICU admission were assessed.

Results: Among 40 patients, 32 (80%) patients were mechanically ventilated. Twenty-six (65%) patients were ever-smokers, 22 (55%) patients had history of alcoholism, and 14 (35%) patients were psychotropic drug users. During ICU admission, percentage of time within target sedation was likely to be lower in smokers (84.07±14.33 versus 73.93±21.22%, respectively, p=0.119) and psychotropic drugs users (79.71±16.52 versus 73.35±23.31%, respectively, p=0.332). Median dose of midazolam was higher in smokers (18.57[13.36-50.00]mg/hr; p=0.111) although it were not statistically significant. Median dose of dexmedetomidine were higher in psychotropic drug users (4.16[1.43-9.36] versus 1.44[0.39-2.90]mcg/kg/hr, respectively, p=0.042).

Conclusions: More than half of the patients admitted to the MICU had smoking and alcohol history. Also 35% of the patients were psychotropic drug users. Patients with history of psychotropic drug use may need higher dose of dexmedetomidine to achieve target sedation.

Keywords: Alcohol, Psychotropic drug, Sedation, Tobacco, Critical care
CLINICAL OUTCOME OF PREEMPTIVE THERAPY IN MECHANICALLY VENTILATED PATIENTS WITH CARBAPENEM-RESISTANT ACINETOBACTER BAUMANNII

Younghoon Choi, Chang Hyeok An, Sang Joon Park, Joo-won Min

Division of Pulmonary and Critical Care Medicine, Department of Internal Medicine, Myongji Hospital, Republic of Korea

Background/Purpose: Recently, carbapenem-resistant Acinetobacter baumannii (CRAB) pneumonia is increasing. However effective treatments are unclear because of toxicity of drugs. The objective of this study is to clarify the outcome of preemptive therapy with nebulized colistin or conventional dose of sulbactam in mechanically ventilated patients.

Methods: Data between Jan. 2013 and Sep. 2013 in mechanically ventilated patients with CRAB in artificial airway were analyzed (survival analysis). In all patients, preemptive treatments were initiated, and treatment arms were classified as 4 groups; no treatment, cefoperazone/sulbactam with minocycline (CS+M), nebulized colistin, and intravenous (IV) colistin groups. And Acinetobacter-growing days, acute kidney injury (AKI)-free days, and 30-day mortality were compared among anti-Acinetobacter treatment groups.

Results: Data of 78 patients were analyzed. The duration of mechanical ventilation was 14.1 ± 9.4 days, and ventilator-associated pneumonia (VAP) was occurred in 58 (74.4%) patients. In 78 patients, no treatment group were 25 (32.1 %), CS+M group were 16 (20.5 %), nebulized colistin group were 14 (17.9 %), and IV colistin groups were 23 (29.5 %). In the univariate analysis, Acinetobacter-growing days were shorter in patients with nebulized colistin, AKI-free days were shorter in patients with CS+M and IV colistin groups, and 30-day mortality was equal in all groups. The Cox proportional hazard model considering patients severity revealed that 30-day mortality was associated with the occurrence of AKI (HR, 3.94; 95% CI, 1.16-13.48). However, the difference among these 4 preemptive therapy groups was not found.

Conclusions: Various preemptive anti-Acinetobacter treatments resulted in different outcome. However, 30-day mortality was not different.

Keywords: Acinetobacter baumannii, Pneumonia, Acute kidney injury, Colistin
A REVIEW OF THE RESPIRATORY FUNCTION: LUNG INJURIES ASSOCIATED WITH HOME HUMIDIFIER USE

Soonyoung Park, Sang-Bum Hong, Jin Won Huh, Chae-man Lim, Younsuck Koh

ASAN Medical Center, Republic of Korea

Background/Purpose: In the spring 2011 in Korea, severe respiratory distress associated with home humidifier use occurred. In this review of respiratory function effects of patient who was hospitalized.

Methods: Medical records of 19 patients, admitted at Asan Medical Center from February 12, 2011 to June 9, 2011, were reviewed.

Results: Among 19 patients, 6 patients was expired, 4 patients underwent lung transplantation. 1 patient of lung transplantation was expired due to acute rejection. The mean age was 36 years old. Except patients who underwent lung transplantation, 10 patients pulmonary function test showed that severe restrictive pulmonary dysfunction (FEV1/FVC 89.86±5.34, FEV1 1.55±0.80L, 47.57±20.14%, FVC 1.75±0.93L, 44.71±18.75%) at admission and improving pulmonary function 42 months after admission (FEV1/FVC 87.25±4.99, FEV1 2.41±1.25L, 71.25±34.69% FVC 2.82±1.52L, 69.00±34.61%) (Table 1). 1 patient of 10 patients showed severe restrictive pulmonary dysfunction progressively (FEV1/FVC 94, FVC 0.58L, 18%, FEV1 0.43L, 20%, 42 months after admission) and waited for lung transplantation with applying noninvasive ventilation. Except patient who was waiting lung transplantation, 9 patients showed more improving pulmonary function, nearly normalized pulmonary function test after lung transplantation (FEV1/FVC 85.00±2.64, FEV1 3.03±0.21L, 88.33±7.37% FVC 3.57±0.35L, 86.00±7.94%) (Table 2). 3 patient who underwent lung transplantation showed normal pulmonary function test after lung transplantation.

Conclusions: The respiratory function of patients of lung injuries associated with home humidifier use showed severe restrictive pulmonary dysfunction at first but were recovered gradually to near normal pulmonary function. But, some exceptional patients required lung transplantation.

Keywords: Home humidifier use, Pulmonary function test, Lung transplantation
Table 1. Surviving 10 patients’ pulmonary function test except underwent lung transplantation patients

<table>
<thead>
<tr>
<th></th>
<th>Admission</th>
<th>After 12months</th>
<th>After 24months</th>
<th>After 36months</th>
<th>After 42months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEV1, value (IQR)</strong></td>
<td>1.55±0.80</td>
<td>2.38±0.94</td>
<td>2.75±0.55</td>
<td>2.69±0.53</td>
<td>2.40±1.25</td>
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<tr>
<td><strong>FEV1, % predicted (IQR)</strong></td>
<td>47.57±20.14</td>
<td>72.50±24.89</td>
<td>80.50±13.16</td>
<td>79.00±14.14</td>
<td>71.25±34.70</td>
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<tr>
<td><strong>FVC, value (IQR)</strong></td>
<td>1.75±0.93</td>
<td>2.82±1.16</td>
<td>3.22±0.83</td>
<td>2.98±0.92</td>
<td>2.82±1.52</td>
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<tr>
<td><strong>FVC, % predicted (IQR)</strong></td>
<td>44.71±18.75</td>
<td>71.50±25.61</td>
<td>77.00±15.52</td>
<td>73.50±20.51</td>
<td>69.00±34.61</td>
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<tr>
<td><strong>FEV1/FVC (IQR)</strong></td>
<td>89.86±5.34</td>
<td>86.00±5.22</td>
<td>86.67±6.59</td>
<td>91.50±10.61</td>
<td>87.25±5.00</td>
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<td><strong>TLC, value (IQR)</strong></td>
<td>2.85±1.24</td>
<td>4.18±0.92</td>
<td>4.20±0.82</td>
<td>4.05±0.90</td>
<td>4.78±0.63</td>
</tr>
<tr>
<td><strong>TLC, % predicted (IQR)</strong></td>
<td>44.82±29.92</td>
<td>80.60±12.24</td>
<td>74.75±11.00</td>
<td>73.00±14.14</td>
<td>85.67±7.10</td>
</tr>
<tr>
<td><strong>DL, %</strong></td>
<td>30.12±10.94</td>
<td>69.20±14.41</td>
<td>66.40±16.89</td>
<td>62.00±14.14</td>
<td>61.25±41.19</td>
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Table 2. Surviving 9 patients’ pulmonary function test except waiting lung transplantation patient

<table>
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<tr>
<th></th>
<th>Admission</th>
<th>After 12months</th>
<th>After 24months</th>
<th>After 36months</th>
<th>After 42months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEV1, value (IQR)</strong></td>
<td>1.67±0.81</td>
<td>2.72±0.47</td>
<td>2.75±0.55</td>
<td>2.69±0.53</td>
<td>3.03±0.21</td>
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<tr>
<td><strong>FEV1, % predicted (IQR)</strong></td>
<td>50.33±20.56</td>
<td>82.20±8.26</td>
<td>80.50±13.16</td>
<td>79.00±14.14</td>
<td>88.33±7.37</td>
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<tr>
<td><strong>FVC, value (IQR)</strong></td>
<td>1.88±0.94</td>
<td>3.24±0.59</td>
<td>3.22±0.83</td>
<td>2.98±0.92</td>
<td>3.57±0.35</td>
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<tr>
<td><strong>FVC, % predicted (IQR)</strong></td>
<td>47.50±18.89</td>
<td>81.40±9.21</td>
<td>77.00±15.52</td>
<td>73.50±20.51</td>
<td>86.00±7.94</td>
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<tr>
<td><strong>FEV1/FVC (IQR)</strong></td>
<td>88.83±5.04</td>
<td>84.20±3.11</td>
<td>86.67±6.59</td>
<td>91.50±10.61</td>
<td>85.00±2.65</td>
</tr>
<tr>
<td><strong>TLC, value (IQR)</strong></td>
<td>2.85±1.24</td>
<td>4.18±0.92</td>
<td>4.20±0.82</td>
<td>4.05±0.90</td>
<td>4.78±0.63</td>
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<tr>
<td><strong>TLC, % predicted (IQR)</strong></td>
<td>44.82±29.92</td>
<td>80.60±12.24</td>
<td>74.75±11.00</td>
<td>73.00±14.14</td>
<td>85.67±7.10</td>
</tr>
<tr>
<td><strong>DL, %</strong></td>
<td>31.40±12.20</td>
<td>69.20±14.41</td>
<td>66.40±16.90</td>
<td>62.00±14.14</td>
<td>80.00±20.88</td>
</tr>
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</table>
IS COLISTIN NEPHROTOXICITY DIFFERENT IN GERIATRIC PATIENTS?

Burcu Basarik Aydogan, Avsar Zerman, Fatma Yildirim, Kamil Gonderen, Melda Turkoglu, Gulbin Aygencel

Gazi University Faculty of Medicine, Intensive Care Fellowship Program, Internal Medicine Intensive Care Unite, Turkey

Background/Purpose: Colistin is an important antibiotic which is used for resistant Gram-negative infection treatment in intensive care units. Its most recognized side effect is nephrotoxicity. The aim of this study was to investigate the differences in colistin nephrotoxicity between a geriatric ≥65 years group and a younger <65 years group. Also we analyzed the risk factors of colistin nephrotoxicity.

Methods: The records of the patients who were given colistin between January 2010 and June 2014 were investigated retrospectively. Demographic features, causes for colistin use, daily colistin dose per body mass, cumulative colistin dose, duration of colistin use, and other comorbid nephrotoxicity causes were recorded.

Results: Seventy-six patients were included the study. The median age of patients was 65, and 65.8% of patients were male. There was nephrotoxicity in 36 (47.4%) patients. Thirty-nine (51.3%) patients were aged ≥65 years, 37 (48.7%) patients were aged <65 years. There was a difference in the presence of male gender (p=0.031), underlying cardiac and pulmonary diseases (p=0.003 and p<0.001), onset of nephrotoxicity (p=0.017), post-nephrotoxicity BUN levels (p=0.023), and urine output in nephrotoxicity (p=0.016) between groups. There was nephrotoxicity in 22 (56.4%) patients in ≥65 years age group and 14 (37.8%) patients in <65 years age group (p=0.115). The daily amounts of colistin per body mass and vasopressor use during hospitalization were independent risk factors in multivariate analysis.

Conclusions: In the present study, age was not a risk factor for colistin nephrotoxicity. Therefore, it was suggested not to avoid using colistin in case of clinical indications in a geriatric patient group.

Keywords: Geriatric patients, Colistin, Nephrotoxity
CONTINUOUS RENAL REPLACEMENT THERAPY IMPROVES SEPTIC SHOCK IN PATIENTS UNRESPONSIVE TO EARLY GOAL-DIRECTED THERAPY

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Department of Anesthesiology and Intensive Care, Oita University Hospital, Japan

Background/Purpose: Early goal-directed therapy (EGDT) has been shown to improve patient outcomes. Treatment of patients unresponsive to the protocol, however, is difficult and the result is occasionally fatal. Recently, continuous renal replacement therapy (CRRT) has been used to treat acute kidney injury (AKI) to improve survival. We examined the effectiveness of CRRT in treating septic shock patients with concurrent AKI who are not amenable to EGDT.

Methods: We studied 17 patients who underwent emergency surgery for intra-abdominal infection; these patients experienced AKI complications and did not respond to EGDT within 6 hrs after intensive care unit (ICU) admission. We treated patients with continuous venovenous hemodiafiltration (CVVHDF; dialysis = 900 ml/hr, filtration = 900 ml/hr, total hemopurification = 1800 ml/hr). We measured mean arterial pressure (MAP), central venous pressure (CVP), central venous oxygen saturation (ScvO2), catecholamine index (CAI), and determined serum concentrations of lactate, interleukin-6 (IL-6), and high mobility group box-1 protein (HMGB-1) immediately before and 3, 6, 12, 24, 48 hrs after CRRT initiation. We also evaluated 28-day survival, ICU survival, and hospital survival.

Results: CRRT duration was 6.5±4.2 days. MAP and ScvO2 significantly increased with CRRT, while CAI and concentrations of lactate, IL-6, and HMGB-1 significantly decreased. After CRRT, no patients required intermittent hemodialysis in the ICU. Mean ICU stay was 15.1±10.4 days. ICU survival, 28-day survival, and hospital survival were 76.5%, 76.5%, and 70.6%, respectively.

Conclusions: CRRT may be an effective treatment for seriously ill patients who have complications of AKI and are unresponsive to EGDT.

Keywords: Early goal-directed therapy, Septic shock, Continuous renal replacement therapy
BENEFIT OF EARLY DETECTION AND NEPHROLOGIC INTERVENTION FOR ACUTE KIDNEY INJURY IN HOSPITAL (BENECIA): A PROSPECTIVE STUDY

Sejoong Kim, Shin Young Ahn, Ho Jun Chin
Seoul National University Bundang Hospital, Republic of Korea

Background/Purpose: Acute kidney injury (AKI) is closely associated with the deterioration of renal function and mortality. Delayed nephrologic intervention may be associated with high mortality in critically ill AKI patients. We performed a prospective large cohort observational study to verify the beneficial effect of electronic system-based early detection of AKI and connected-early nephrologic intervention on the progression of AKI and clinical outcomes in hospitalized patients.

Methods: We enrolled admitted patients with measuring serum creatinine levels once or more from 2014 June to 2014 November in a tertiary hospital.

Results: During 6-month period, 1171 out of 17627 patients were detected with AKI (incidence, 6.6%), of whom 201 patients (alarm related consult group, AG) were referred to the nephrologists using the early alert referral system, and 769 patients (no consult group, NG) were not referred after duty physicians got alarm signals. The referral time between AKI development and nephrologic consultation was 1.26 ± 2.88 day in the AG. The in-hospital mortality rate was decreased in the AG by 12.5% (8.0% in the AG vs. 22.5 in the CG, P < 0.01). The early alert referral system reduced the in-hospital mortality risk by 67% (Adjusted hazard ratio of AG, 0.33 [0.15 0.69], P < 0.01). Survey to the responsive physician showed that 90% of physician answered that this system was useful for patients and clinical practice, which helped rapid clinical diagnosis of AKI and quick referral to the nephrologic experts.

Conclusions: These results found that BENECIA system improve in-hospital mortality, and encouraged physicians awareness and rapid therapeutic intervention.

Keywords: Acute kidney injury, Survival, Referral time
THE ASSOCIATION BETWEEN FILTER LIFE AND INTRA-CIRCUIT ACTIVATED CLOTTING TIME DURING CONTINUOUS RENAL REPLACEMENT THERAPY USING NAFAMOSTAT MESILATE

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Background/Purpose: Nafamostat mesilate (NM) was used as anticoagulant for continuous renal replacement therapy (CRRT). However, there is no study to assess the association between filter life and intra-circuit activated clotting time (ACT) during CRRT using NM.

Methods: We retrospectively studied 76 patients who required CRRT using NM in our ICU from 2011 to 2013. The primary outcome was filter life. NM was administered before filter without bolus, and started by 15 to 25 mg/hour. We calculated pre and post-filter ACT measured 1h after commencement of CRRT (pre-1stACT and post-1stACT) and time weighted average of ACT (pre-twACT and post-twACT). We divided filters into two groups according to the median of each ACT. Filter life was compared between two groups using the Kaplan-Meier method. P-value <0.05 was considered to be statically significant.

Results: We studied 173 filters in total. For pre-1stACT, mean ACT for lower group was 131 seconds and 174 seconds for higher group. There was no significant difference of filter life between lower and higher group (26 vs 22 hours, p=0.90). For post-1stACT (mean ACT; 199 vs 307 seconds), there was no significant difference of filter life between two group (28 vs 22 hours, p=0.50). For pre and post-twACT (mean ACT; pre-twACT, 131 vs 168 seconds, post-twACT, 208 vs 294 seconds), there was also no significant difference in filter life (pre-twACT; 26 vs 22 hours, p=0.90, post-twACT; 26 vs 22 hours, p=0.77).

Conclusions: When NM was used as anticoagulant for CRRT, the intra-circuit ACT appeared not to be a good predictor of filter life.

Keywords: Nafamostat mesilate, Activated clotting time, Filters
THE EFFICACY OF PLASMA EXCHANGE FOR DIARRHEA-ASSOCIATED HEMOLYTIC UREMIC SYNDROME: A CASE SERIES

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Background/Purpose: The effectiveness of plasma exchange (PE) for the treatment of diarrhea-associated hemolytic uremic syndrome (D+HUS) is controversial. We perform PE only for patients with central nervous system (CNS) symptoms during the course. In this study, we evaluated the associations among whether or not PE was performed, the timing of its initiation, CNS symptoms, and improvements in the renal function in D+HUS patients.

Methods: Patients with D+HUS who were admitted to our ICU between September 2010 and June 2014 were selected, and the presence or absence of CNS symptoms, whether or not PE was performed, timing of its initiation, and duration of renal replacement therapy (RRT) were retrospectively investigated.

Results: Since all five patients were anuric, RRT was initiated on admission to the ICU. In addition, PE was performed for 3 days in 4 patients who showed CNS symptoms during the course in the ICU. PE was introduced 9, 10, 12, and 12 days from the onset of D+HUS, and the duration of RRT was 9, 13, 23, and 23 days, respectively. In the patient who showed no CNS symptoms and did not undergo PE, the duration of RRT was 36 days, being longer than in the 4 patients received PE. None of these 4 patients had clear CNS symptoms at discharge from the ICU.

Conclusions: According to this study, recovery of the renal function was slower in those with no CNS symptoms or their late occurrence, but faster in those in whom PE was initiated earlier. The further accumulation of cases is necessary.

Keywords: Plasma exchange, Hemolytic uremic syndrome
IMPACT OF ANEMIA ON THE RISKS OF ACUTE KIDNEY INJURY AND MORTALITY IN CRITICALLY ILL PATIENTS

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Background/Purpose: Anemia is related to the acute kidney injury (AKI) in several clinical settings. However, their relationship and its effect on long-term mortality remain unresolved in critically ill patients.

Methods: A total of 2,145 patients admitted to the intensive care unit were retrospectively analyzed. Threshold value of hemoglobin to increase the risk of AKI was determined using the Youden index of ROC curve. The adjusted odds ratios (ORs) and hazard ratios (HRs) for AKI and all-cause mortality were calculated after adjustment of multiple clinical and laboratory covariates.

Results: The AKI risk increased depending on the decrease in hemoglobin level (Figure 1). The best threshold point of hemoglobin for increasing AKI risk was 10.55 g/dL; accordingly, we categorized patients into anemia (<10.55 g/dL) and non-anemia (≥10.55 g/dL) groups. The adjusted OR of AKI was 1.35 (1.041 - 1.753) in anemia group compared with non-anemia group. When the patients were divided into 4 groups by anemia and AKI, the mortality risks were significantly separated by these factors (Figure 2). The adjusted HRs compared with non-anemia and non-AKI group were as follows: HR [anemia (+) and AKI (-)], 1.29 (0.963 - 1.725); HR [anemia (-) and AKI (+)], 1.92 (1.590 - 2.317); and HR [anemia (+) and AKI (+)], 2.29 (1.877 - 2.795).

Conclusions: Anemia increases the risk of AKI in critically ill patients. Furthermore, it exacerbates the effect of AKI on mortality of this subset.

Keywords: Anemia, Acute kidney injury, Hemoglobin, Mortality
ASSOCIATION BETWEEN DEFICIT OF HEMODYNAMIC PARAMETERS AND ACUTE KIDNEY INJURY IN PATIENTS WITH SHOCK: A RETROSPECTIVE OBSERVATIONAL STUDY

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Background/Purpose: There are limited studies indicating putative benefits of adjusting blood pressure targets for patients with shock according to pre-morbid levels. We aimed to investigate changes between the achieved hemodynamic parameter levels in vasopressor-treated patients and pre-morbid levels to find out which hemodynamic parameters have an association with development of subsequent acute kidney injury (AKI).

Methods: 76 consecutive patients who were 18 years old or older, had cardiovascular surgery, and required vasopressor support more than 4 hours in our ICU were included in the study. We assessed the mean deficit [=(basal value - achieved value) / basal value] of systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), central venous pressure (CVP), and mean perfusion pressure (MPP, defined as MAP - CVP) for each patient. Progression of AKI was defined as ≥1 class increase in Risk, Injury, Failure, Loss, End-stage kidney disease (RIFLE) criteria within 72 hours after commencing vasopressor support.

Results: Thirty-one (41%) patients were found to have progression of AKI. Achieved hemodynamic parameters were similar between patients with and without progression of AKI during vasopressor support. However, patients with progression of AKI had higher MPP deficit (21% vs. 27%; p=0.044) and DAP deficit (20% vs. 27%; p=0.041) compared to patients without progression of AKI.

Conclusions: In terms of relative hypotension, this result suggests that the deficit of MPP and DAP should be considered as adjustable hemodynamic parameters for therapy for patients with shock.

Keywords: Blood pressure, Acute kidney injury, Perfusion pressure
<Image 1>
CLINICAL USEFULNESS OF SERIAL NEUTROPHIL GELETINASE-ASSOCIATED LIPOCALIN (NGAL) AS A PREDICTOR FOR ACUTE KIDNEY INJURY

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Background/Purpose: Plasma neutrophil geletinase-associated lipocalin (NGAL) has been regarded as one of the valuable markers of development of acute kidney injury (AKI) in ICU admitted patients. However, clinical significance of short-term change of plasma NGAL was not clearly investigated.

Methods: 50 patients who admitted intensive care unit (ICU) was included by prospective manner. We analyzed plasma NGAL level by Triage immunoassay on ICU admitted time and 12 hours after. Change of estimated glomerular filtration rate (by MDRD equation) and need of renal replacement therapy was investigated. Patients with chronic kidney disease were excluded.

Results: Persistent elevation of plasma NGAL above 1,000 ng/mL on 0 and 12 hours was significantly associated with need for early renal replacement therapy. Patient with increased level of NGAL at 12 hours showed unfavorable outcome which is related to renal replacement therapy or progressive renal impairment (13/25; 48% of patients). Conversely, 2/17 (11.8%) of patients had poor renal outcome when NGAL decrease more than 20% from baseline at 12 hours after ICU admission. On multivariate analysis, baseline NGAL and NGAL0-12hr was independent predictors of unfavorable renal outcome. However, NGAL0-12hr did not significantly correlated with the change of glomerular filtration rate between day 1 and day 3.

Conclusions: Our data suggest that measurement of early serum NGAL change may be useful marker in predicting the renal impairment and need for renal replacement therapy in intensive care unit.

Keywords: Neutrophil geletinase-associated lipocalin, Acute kidney injury
RISK FACTORS FOR POSTOPERATIVE ACUTE KIDNEY INJURY IN CRITICALLY ILL SURGICAL PATIENTS WITH PERITONITIS

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Background/Purpose: The aim of this study was to assess clinical characteristics and risk factors of the postoperative acute kidney injury (AKI) in critically ill patients with secondary peritonitis.

Methods: The medical records of 143 patients from Jan 2007 to Dec 2011 were reviewed. The patients with preoperative AKI (preoperative serum creatinine over 2.0mg/dl) or chronic renal disease were excluded. Postoperative AKI was defined when AKI was developed within 48 hours after surgery. Patients were divided into two groups according to the presence of AKI using the acute kidney injury network (AKIN) staging system based on the serum creatinine elevation or oliguria. A logistic regression multivariate analysis was performed after matching on the propensity score.

Results: Forty-five patients developed postoperative AKI. AKI stages were followings; stage I (28), stage II (10), stage III (7), respectively. Renal replacement therapy was applied in 9 patients, stage I (5, 18%), stage II (1, 10%), III (3, 43%). Preoperative sepsis (odds ratio [OR] 6.443; 95% confidence interval [CI] 1.438-28.862; P = 0.015) and postoperative use of vasopressors (OR, 5.211; 95% CI, 1.495-18.169; P = 0.010) are identified as independent risk factors for AKI.

Conclusions: Preoperative sepsis and postoperative use of vasopressors are the risk factors associated with the postoperative AKI in critically ill surgical patients with secondary peritonitis.

Keywords: Acute kidney injury, Peritonitis
PRECEDING HYponatremia predicts the Severity and Mortality of Acute Kidney Injury in Admitted Patients

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Background/Purpose: Hyponatremia is a common electrolyte disorder in admitted patients. However, little information is known in patients with acute kidney injury (AKI) and its impact on their clinical hard endpoints.

Methods: We consecutively enrolled the admitted patients with the development of AKI in our tertiary hospital AKI cohort for 6 months. Serum sodium levels were categorized as normonatremia (135-145 mEq/L), mild (130-134 mEq/L), moderate (120-129 mEq/L), and severe (<120 mEq/L) hyponatremia.

Results: In 1,278 patients with AKI, hyponatremia at admission (serum sodium < 135 mEq/L) was noted in 33% of patients: mild in 22%, moderate in 10%, and severe in 1%. Using the first admission data, AKI stage 2 or 3 was 19.8% for patients with normonatremia and 28.2%, 41.4%, and 41.7% for those with mild, moderate, and severe hyponatremia, respectively. In-hospital mortality was 12.0% for patients with normonatremia and 26.5%, 40.6%, and 58.3% for those with mild, moderate, and severe hyponatremia, respectively. The respective hazard ratio for in-hospital mortality, using patients with euonatremia as reference, were 1.43 (95% CI, 0.96-2.12; P = 0.07) in mild, 1.90 (95% CI, 1.21-2.98; P < 0.01) in moderate, and 11.2 (95% CI, 3.16-39.6; P < 0.01) in severe hyponatremia.

Conclusions: Hyponatremia in patients with AKI is associated with higher stage of AKI and higher in hospital mortality. Whether long-term correction of hyponatremia would improve these outcomes remains to be determined.

Keywords: Acute kidney injury, Hyponatremia, In-hospital mortality
THE USEFULNESS OF SERUM CYSTATIN C MEASUREMENT IN EARLY DIAGNOSIS AND PREDICTION OF ACUTE KIDNEY INJURY IN SEPSIS PATIENTS

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Yonsei University College of Medicine, Republic of Korea

Background/Purpose: Acute kidney injury (AKI) is a common problem in critically ill patients. Serum cystatin C has emerged as a reliable marker of AKI. We performed this study to assess the role of serum cystatin C for early diagnosis and prediction of renal function in sepsis patients.

Methods: We evaluated 162 sepsis patients (113 of AKI patients and 49 of non-AKI patients) who were admitted to the intensive care unit of a university-affiliated hospital in Korea. Serum levels of creatinine, glomerular filtration rate (GFR), and cystatin C were measured on days 0, 1, 3, and 7.

Results: Serum cystatin C levels were significantly higher in patients with AKI compared with non-AKI patients on days 0, 1, 3, and 7. In adjusted analysis for age, sex, SOFA score, and underlying diseases, increases in serum cystatin C levels on day 0 were associated with development of AKI (odds ratio [OR] = 20.77; 95% confidence interval [CI] = 4.22-102.35, p < 0.001). In linear mixed model analysis, over time the variation in cystatin C between early recovery and late or non-recovery groups differed significantly (P = 0.001). Through multivariate analysis, high levels of serum cystatin C levels at day 0 (OR = 1.62; 95% CI = 1.02-2.56, p = 0.04) and day 3 (OR = 4.50; 95% CI = 1.53-13.24, p = 0.04) were associated with late or non-recovery of AKI among the AKI patients.

Conclusions: Our study showed that serum cystatin C level was associated with development and worsening of AKI in ICU patients with sepsis.

Keywords: Cystatin C, Acute kidney injury, Sepsis, Intensive care unit
ELEVATED SERUM NEUTORPHIL GELATINASE-ASSOCIATED LIPOCALIN (NGAL) IS AN EARLY MARKER OF ACUTE KIDNEY INJURY AND ASSOCIATED WITH MORTALITY IN CRITICALLY ILL MAJOR TRAUMA PATIENTS

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The Catholic University of Korea, Uijeongbu St. Mary's Hospital, Republic of Korea

Background/Purpose: Acute kidney injury (AKI) is a one of important factors that effect on survival of major trauma patients. NGAL has been known as an early, sensitive, non-invasive biomarker for AKI. The aim of this study was to evaluate elevated serum NGAL levels as a predictor of a early AKI and prognostic factor in major trauma patients.

Methods: We studied 35 major trauma patients (injury severity score>15) admitted to the intensive care unit of a trauma hospital retrospectively. NGAL was measured using an ELISA technique upon 24 hours after injuries. Presence of AKI during within5 days after trauma was defined by the risk injury failure loss and end-stage kidney classification (RIFLE) criteria.

Results: A total of 35 patients (28 male, 7 female) were studied and mean ISS was 24.6 (16-53). A cut-off point of serum NGAL was larger than 153 ng/ml. 17 patients had elevated serum NGAL level and mean NGAL level was 314 ng/ml. patients with early AKI development was 15 and mean duration of development ofl AKI was 1.6 days. Elevated serum NGAL levels are associated with AKI (p=0.001), shock (p=0.022), ISS (p=0.031), age (p=0.008), baseline serum creatinine (p=0.23) and mortality (p=0.41). Multivariated analysis showed that lactic acid (p=0.017), base deficit (p=0.021) and shock (p=0.008) were statistically associated with mortality of major trauma patients.

Conclusions: Serum NGAL from 24 hours of major trauma can be used as a reliable predictor of AKI and associated with mortality in major trauma patients.

Keywords: Neutrophil gelatinase-associated lipocalin, Major trauma, Acute kidney injury
POSITIVE FLUID BALANCE & HIGH AMOUNT OF 0.9% NSS WERE ASSOCIATED WITH EARLY AKI IN NONCARDIAC, NONSEPSIS SURGICAL PATIENTS ADMITTED TO GENERAL SURGICAL ICU

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Background/Purpose: Periop AKI is a significant factor determining periop morbidity/mortality in sick surgical pts. The aim of this study was to determine prevalence & risk factors of early AKI(< 72 hrs of ICU admission) in nonsepsis, noncardiac surgical pts admitting to the ICU.

Methods: This prospective observational study was done in 600 nonsepsis, noncardiac surgical pts admitting to the ICU. The following data were collected: pts demographic data, ASA, co-morbidities, type & urgency of surgery, type of anesthesia, preop & first 72 hrs laboratory data, amount of bleeding, type/amount of fluid/blood replacement, average intraop & first 72 hrs MAP, ICU length of stay, ventilator days, ICU mortality. AKI was defined & classified according to the AKIN criteria by using adjusted Cr (Macedo E, 2010).

Results: The incidence of early AKI was 41.7% (AKIN-I 31.0%, AKIN-II 10%, AKIN-III 29%), 4.8% received RRT. Multiple logistic regression showed independent risk factors of early AKI were: baseline GFR < 60 ml/min/1.73m² (OR 1.53; 95% CI, 1.08-1.27), admitted serum albumin < 2 mg/dL (OR 1.75; 95% CI, 1.01-3.06), admitted Hb < 8 gm/dL (OR 4.1; 95% CI, 1.14-14.51), positive fluid balance (OR 2.25; 95% CI, 1.6-5.78, receiving 6% HES > 20 ml/Kg/day (OR 2.02; 95% CI, 1.09-3.76)), receiving 0.9% NSS (OR 2.05; 95% CI, 1.55-6.48). Pts who developed AKI had longer ventilator hrs (p = 0.03) & ICU length of stay (p = 0.04).

Conclusion: Almost half of sick surgical admitting to the ICU developed AKI. Receiving 6% HES > 20 ml/Kg/day, positive fluid balanced & receiving 0.9% NSS increase risk for developing early AKI in non septic, non cardiac surgical patients.

Key word: AKI, Noncardiac surgery, 6% HES, 0.9% NSS, Positive fluid balanced
NIGHT SHIFT DOES NOT EFFECT THE SURVIVAL RATE OF NON-TRAUMATIC OUT-OF-HOSPITAL CARDIAC ARREST PATIENTS IN CENTRAL TAIWAN

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Background/Purpose: Out-of-hospital cardiac arrest (OHCA) patients are more likely to have high severity and low survival rate. From past studies, the mortality predictor were witness, bystander CPR, initial rhythm and others. The hospital factors were less discussed. The aim of this study is to demonstrate an association between night shift and the OHCA patient mortality.

Methods: We retrospectively reviewed the OHCA patients in a 500 beds regional hospital in Middle Taiwan from 2012 to 2014. We divided patients according to the times when they were sent to emergency department as day group (from 8:00 to 16:00) and night group (from 16:00 to 24:00). Recording variables were gender, age, response time, AED use and CPR characters. The primary endpoint was patient return of spontaneous circulation (ROSC) rate and the second endpoint was survival to discharge rate. We used Pearsons chi-square test for categorical variables and multiple logistic regression analysis to estimated odds ratio of variables.

Results: Total 339 non-traumatic OHCA patients were enrolled. Mean age was 70±15 years old. Sixty two percent of the OHCA patients were male. The ROSC rate and survival to discharge rate were 24.3% and 3.8% respectively. The predictors of ROSC were initial PE A rhythm (OR: 5.7 CI:2.88-11.26) and prehospital AED shock(OR: 1.52 CI: 0.62-3.73). There was no significant association between the night shift and the rates of ROSC, or survival to discharge rate.

Conclusions: Day shift and Night shift facility did not effect the survival rates of out-of-hospital cardiac arrest patients in central Taiwan.

Keywords: Out-of-hospital cardiac arrest, Night shift, Mortality

Table 2. The cumulative rate of ROSC and survive to discharge in OHCA patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>ROSC</th>
<th>Survive to discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Case(%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>209</td>
<td>48(23.0)</td>
</tr>
<tr>
<td>Female</td>
<td>130</td>
<td>33(25.4)</td>
</tr>
<tr>
<td>Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day shift</td>
<td>143</td>
<td>38(26.6)</td>
</tr>
<tr>
<td>Night shift</td>
<td>196</td>
<td>43(21.9)</td>
</tr>
<tr>
<td>Initial Rhythm</td>
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<td></td>
</tr>
<tr>
<td>Asystole</td>
<td>282</td>
<td>49(17.4)</td>
</tr>
<tr>
<td>PEA</td>
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<td>28(57.1)</td>
</tr>
<tr>
<td>Vf\VT</td>
<td>8</td>
<td>4(50.0)</td>
</tr>
<tr>
<td>Bystander CPR</td>
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<td></td>
</tr>
<tr>
<td>With CPR</td>
<td>16</td>
<td>4(25.0)</td>
</tr>
<tr>
<td>Without CPR</td>
<td>323</td>
<td>77(23.8)</td>
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<tr>
<td>AED shock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With shock</td>
<td>31</td>
<td>15(48.4)</td>
</tr>
<tr>
<td>Without shock</td>
<td>308</td>
<td>66(21.4)</td>
</tr>
</tbody>
</table>
THE NEED FOR EXTRACORPOREAL CARDIOPULMONARY RESUSCITATION AMONG PATIENTS WITH OUT-OF-HOSPITAL CARDIAC ARREST DUE TO ACUTE CORONARY SYNDROME

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Background/Purpose: Although the major cause of out-of-hospital cardiac arrest (OHCA) is acute coronary syndrome (ACS), its resistance to cardiopulmonary resuscitation (CPR) depends on the individual. Extracorporeal cardiopulmonary resuscitation (ECPR) has been reported to be effective for patients in whom return of spontaneous circulation (ROSC) cannot be achieved by conventional CPR. The aim of this study was to investigate who will require ECPR among patients with OHCA due to ACS.

Methods: Between October 2009 and October 2014, we retrospectively analyzed 87 consecutive OHCA patients complicated by ACS who were diagnosed according to findings on coronary angiography. We then compared baseline characteristics, prehospital records, and coronary angiographic findings between ECPR and non-ECPR cases.

Results: Among the 87 cases, 35 and 52 achieved ROSC by ECPR and conventional CPR, respectively. No significant differences were observed between ECPR and non-ECPR cases in median age (61 vs 65 y, respectively), bystander-witnessed arrest (89% vs 94%), bystander-initiated CPR (40% vs 54%), initial ventricular fibrillation arrest rhythm (71% vs 83%), 911 call-to-shock time (7 min vs 7 min), 911 call-to-arrival time (40 min vs 40 min), culprit coronary artery lesions (left anterior descending, 51% vs 58%; left circumflex, 3% vs 12%; right, 26% vs 21%; left main, 20% vs 10%), or Thrombolysis in Myocardial Infarction (TIMI) flow grade on initial assessment of coronary angiography (TIMI flow grade 2-3, 31% vs 44%).

Conclusions: Our findings were unable to clarify the mechanism underlying the resistance to CPR among patients with OHCA due to ACS. Future studies are needed to identify these resistance factors.

Keywords: Extracorporeal cardiopulmonary resuscitation
TRENDS IN NEUROLOGICALLY FAVORABLE SURVIVAL AFTER ELDERLY OUT-OF-HOSPITAL CARDIAC ARREST IN JAPAN

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Background/Purpose: Population aging has rapidly advanced throughout the world. This study aimed to investigate temporal trends in rates of favorable outcomes for elderly out-of-hospital cardiac arrest (OHCA) patients and to examine the influence of advanced age on outcomes.

Methods: We conducted a nationwide, population-based, observational study of data from the All-Japan Utstein Registry, which included 658,829 adults experienced OHCA from January 1, 2005 to December 31, 2010. The primary endpoint was favorable neurological outcome one month after OHCA.

Results: Among 605,505 patients, 454,755 (75.1%) were the elderly (≥ 65 years), and 154,785 (25.6%) were the oldest old (≥ 85 years). Although neurological outcome was worse as the age group was older (P<0.0001 for trend), there was a significant trend toward increased favorable neurological outcome depending on the age group (P<0.005 for trend). After adjustment for temporal trends in patient, cardiac arrest, procedural, and pre-hospital characteristics, neurological outcome improved yearly in any age groups (18-64 years: adjusted OR per year 1.15, 95% CI 1.13-1.18; 65-84 years: adjusted OR per year 1.12, 95% CI 1.10-1.15; and ≥ 85 years: adjusted OR per year 1.08, 95% CI 1.04-1.13). Similar trends were found in the rate of favorable neurological outcome among survivors.

Conclusions: Although neurological outcome from OHCA was worse as the age group was older, the rates of favorable neurological outcome in Japan have substantially improved since 2005 even in the elderly, including the oldest old. Careful consideration may be necessary in limiting treatment on OHCA solely for the reason of advanced age.

Keywords: Out-of-hospital cardiac arrest, Elderly, Trend
EXTRACORPOREAL CARDIOPULMONARY RESUSCITATION FOR CARDIAC ARREST WITH DEEP HYPOTHERMIA IS ASSOCIATED WITH FAVORABLE SURVIVAL

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Background/Purpose: In patients with deep hypothermic cardiac arrest (CA), there is consensus that treatment with extracorporeal cardiopulmonary resuscitation (ECPR) is effective, and the rate of favorable outcome has been reported as 47-63%. However, the available data are still limited. In the present study, we investigated the neurological outcomes after ECPR in CA patients with deep hypothermia (core temperature <28°C) treated at our center.

Methods: We implemented a retrospective review of CA patients with core body temperature <28°C in whom ECPR was performed at our center. The demographic characteristics, cardiopulmonary resuscitation and ECPR details, and neurological outcomes were evaluated.

Results: Fifteen patients (male, 7; female, 8; mean age, 54 ± 24 years; mean core temperature, 23.8°C ± 2.9°C) with deep hypothermic CA underwent ECPR between 2005 and 2014. The presumed causes of CA were accidental hypothermia (primary hypothermia) in 9 patients, and other causes with secondary hypothermia in 6 patients. Overall, 7 patients (47%) survived and had favorable outcomes, with a cerebral performance category scale score of 1. All favorable outcomes occurred in primary hypothermic CA patients, with the rate of favorable outcome thus being 78% in these patients. The favorable outcome group had significantly higher arterial pH, lower partial pressure of carbon dioxide, and lower lactate dehydrogenase levels on arrival than the unfavorable outcome group. However, binary logistic regression analysis revealed that there was no significant independent factor associated with the outcome.

Conclusions: ECPR appears effective for rescuing CA patients with deep hypothermia, especially of primary hypothermic origin, similar to that noted in previous reports.

Keywords: Hypothermia, Cardiac arrest, Extracorporeal cardiopulmonary resuscitation
CHANGE IN SERUM CHLORIDE LEVEL AFTER LOADING DOSE OF STEROFUNDIN SOLUTION COMPARED WITH NORMAL SALINE SOLUTION

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Ramathibodi Hospital, Thailand

Background/Purpose: When infusing normal saline solution, there is concern about hyperchloremic metabolic acidosis. Sterofundin is the new balanced-salt solution designed for reducing this problem by decreasing solutions chloride level while maintaining osmolality. To evaluate plasma compositions after loading dose of Sterofundin given to healthy volunteers in the resuscitation manner compared with normal saline solution.

Methods: 10 healthy volunteers were randomly assigned to receive either normal saline or Sterofundin for the first solution in dose of 30 ml/kg (max 2 L) over 1 hour. After wash out period of at least 1 week, crossover studies were performed. Blood was collected at baseline (T0), 60 minutes (T1), 120 minutes (T2), and 240 minutes (T4) from baseline. Time to first void was also recorded. Primary outcome was change in serum chloride level. Secondary outcomes were change in serum pH, osmolality, and SIda level and time required until first void after initiation of fluid.

Results: With Sterofundin loading, delta chloride increase was significantly lower (p = 0.021). Delta SIda decrease was more pronounced with normal saline solution (p = 0.017), while there was no significant change in serum pH, and osmolality level (p = 0.094, and 0.982, respectively). Time to first void was significantly shorter after receiving Sterofundin solution (p = 0.008) with larger but not statistically significant urine volume (p = 0.068).

Conclusions: Sterofundin solution given in the resuscitation manner to healthy volunteers results in slightly increased serum chloride level but delta change from baseline was significantly lower as compared with normal saline solution loading.

Keywords: Sterofundin, Saline, Resuscitation, Fluid, Chlorid
RESULTS OF EXTRACORPOREAL CARDIOPULMONARY RESUSCITATION FOR OUT-OF-HOSPITAL CARDIAC ARREST: PROPENSITY SCORE MATCHING

Euysuk Chung, Jaehun Lee, Dongwon Kim, Byung Ok Kim, Young Sup Byun, In Hyun Chung, Hye Young Lee, Seok Yong Ryu, Suk Jin Cho, Sung Chan Oh, Hye Jin Kim

1Inje University Sanggye Paik Hospital, Republic of Korea

Background/Purpose: Out-of-hospital cardiac arrest (OHCA) is not rare. In spite of conventional cardiopulmonary resuscitation (C-CPR), its mortality rate is very high. Extracorporeal CPR (E-CPR) was reported to be effective in cardiac arrest patients. We tried the E-CPR on the OHCA and compared the results to that of the C-CPR in the same period.

Methods: From April 2010 to October 2014, 582 OHCA patients visited the emergency room. Among them, 126 patients who visited cardiovascular causes (M: F = 90: 36 Mean age = 65.8 ± 14.6 years) were reviewed the medical records and 119 rescue team reports, retrospectively. We divided them into two groups (C-CPR: E-CPR = 97: 29) and analyzed them. Thereafter, we choose the 23 pairs with propensity score matching method (59.2 ± 12.6 yrs, M: F = 40: 6), and re-analyzed them (Fig.1, Table 1).

Results: ROSC, survival discharge, Cerebral Performance Categories Scale 1, 2 and 30 day survival rate was superior in the E-CPR group (p<0.05). But, in the basic characteristics before hospital arrival and propensity score were different (p<0.05, Table 1). The propensity score matching was performed. There were no differences in all basic characteristics. But, O2 saturation and mean blood pressure after ROSC were higher and aggressive treatment could be performed on the E-CPR support group (p<0.05, table 1). There showed survival and neurological advantages in the pE-CPR group (p<0.05, table1).

Conclusions: In this study, E-CPR management was more stable than that of C-CPR and it could improve clinically results including survival rate. In the future, this seems to require a long-term observation and appropriate clinical applications.

Keywords: Cardiopulmonary resuscitation, Extracorporeal membrane oxygenation, Cardiac arrest
<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Total (n=46)</th>
<th>mE-CPR (n=23)</th>
<th>mC-CPR (n=23)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>59.2±12.6</td>
<td>59.3±13.7</td>
<td>59.1±11.8</td>
<td>0.96</td>
</tr>
<tr>
<td>M: F</td>
<td>40/6</td>
<td>21/2</td>
<td>19/4</td>
<td>0.38</td>
</tr>
<tr>
<td>DM</td>
<td>9/46</td>
<td>5/23</td>
<td>4/23</td>
<td>0.71</td>
</tr>
<tr>
<td>HTN</td>
<td>23/46</td>
<td>13/23</td>
<td>10/23</td>
<td>0.57</td>
</tr>
<tr>
<td>CRF</td>
<td>3/46</td>
<td>2/23</td>
<td>1/23</td>
<td>0.55</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>2/46</td>
<td>1/23</td>
<td>1/23</td>
<td>1.00</td>
</tr>
<tr>
<td>Previous Cardiac Disease</td>
<td>17/46</td>
<td>9/23</td>
<td>8/23</td>
<td>0.79</td>
</tr>
<tr>
<td>Limitations of Daily Living</td>
<td>4/46</td>
<td>2/23</td>
<td>2/23</td>
<td>1.00</td>
</tr>
<tr>
<td>Non Witness Cardiac Arrest</td>
<td>10/46</td>
<td>4/23</td>
<td>6/23</td>
<td>0.43</td>
</tr>
<tr>
<td>ER Arrival with Cardiac Arrest without CPR</td>
<td>5/46</td>
<td>3/23</td>
<td>2/23</td>
<td>0.67</td>
</tr>
<tr>
<td>Night ER Arrival</td>
<td>16/46</td>
<td>9/23</td>
<td>7/23</td>
<td>0.58</td>
</tr>
<tr>
<td>Non Shockable Rhythm</td>
<td>31/46</td>
<td>15/23</td>
<td>16/23</td>
<td>0.71</td>
</tr>
<tr>
<td>Arrest to 1st CPR Duration (min)</td>
<td>7.4±8.7</td>
<td>8.0±9.0</td>
<td>6.8±8.6</td>
<td>0.67</td>
</tr>
<tr>
<td>Out-of-hospital CPR Time (min)</td>
<td>10.4±6.1</td>
<td>9.9±4.8</td>
<td>11.0±7.3</td>
<td>0.55</td>
</tr>
<tr>
<td>Propensity Score</td>
<td>0.6±0.2</td>
<td>0.6±0.2</td>
<td>0.6±0.2</td>
<td>0.78</td>
</tr>
<tr>
<td>Hospital CPR time (min)</td>
<td>38.6±26.5</td>
<td>48.8±29.5</td>
<td>26.9±16.3</td>
<td>0.03</td>
</tr>
<tr>
<td>Total CPR (min)</td>
<td>45.7±23.5</td>
<td>59.7±29.0</td>
<td>36.8±16.6</td>
<td>0.03</td>
</tr>
<tr>
<td>Coronary Angiography</td>
<td>18/46</td>
<td>16/23</td>
<td>2/23</td>
<td>0.00</td>
</tr>
<tr>
<td>Coronary Intervention</td>
<td>11/46</td>
<td>10/23</td>
<td>1/23</td>
<td>0.00</td>
</tr>
<tr>
<td>ROSC</td>
<td>35/46</td>
<td>22/23</td>
<td>13/23</td>
<td>0.02</td>
</tr>
<tr>
<td>Alive Discharge</td>
<td>11/46</td>
<td>8/23</td>
<td>3/23</td>
<td>0.08</td>
</tr>
<tr>
<td>CPC 1,2</td>
<td>9/46</td>
<td>7/23</td>
<td>1/23</td>
<td>0.04</td>
</tr>
<tr>
<td>30days Survivors</td>
<td>9/46</td>
<td>8/23</td>
<td>1/23</td>
<td>0.02</td>
</tr>
</tbody>
</table>


Table 1. Clinical Results of CPR (Propensity Score matched Group)

![Figure 1](image-url)
ULTRASOUND VS LANDMARK TECHNIQUE: STUDY OF INTERNAL JUGULAR VEIN CANNULATION IN INTENSIVE CARE UNIT

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¹Kathmandu Medical College Teaching Hospital, Nepal, ²Kathmandu Medical College Teaching Hospital, Nepal

Background/Purpose: Find out if an ultrasound technique has advantages over the conventional landmark technique during central venous cannulation in patients admitted in intensive care unit.

Methods: Prospective randomized comparative study on 120 patients requiring central venous cannulation in intensive care.

Results: The number of attempts was 1.5 (1 - 3) and 2 (1 - 3) in the ultrasound and landmark group respectively (p = 0.001). The first attempt success rate was 39/60 (63 %) in the ultrasound group and 19/60 (32 %) with the landmark technique. The seven (12 %) failure cases in the landmark group were rescued by the ultrasound technique. Inadvertent carotid artery puncture occurred in 2/60 (3 %) and 6/60 (10 %) of patients in the ultrasound and landmark group respectively.

Conclusions: Ultrasound improves success rate and reduces complications during internal jugular vein cannulation. It can be employed as a rescue technique in cases of a failed landmark technique in Intensive care setup.

Keywords: Central venous cannulation, Ultrasound, ICU
THE EXPERIENCE OF RAPID RESPONSE SYSTEM IN A REGIONAL TERTIARY HOSPITAL; THE IMPACT AND FEASIBILITY

Jae Young Moon¹, Jusang Lee¹, Jun Wan Lee¹, Na Eun Min¹, Jeong Eun Park¹, Jae Wook Jung¹, Dong Il Park¹, Kun Dong Kim², Hong Joon Ahn², Bo Mi Park¹, Jae Woo Choi¹, Yeon-hee Park¹, Seong Yoo³, Wonjun Jung¹

¹Chungnam National University Hospital, Republic of Korea, ²Yuseong Sun Hospital, Republic of Korea, ³Chungnam National University College of Medicine, Republic of Korea

Background/Purpose: Rapid response system (RRS) is an effective strategy to reduce the rates of cardiopulmonary arrest. However, RRS needs a lot of financial and human resources. In May, 2014, the first RRS for a regional referral hospital was introduced in Korea. The aim of this study was to evaluate the effect of the implementation of RRS and examine the feasibility.

Methods: The study was designed as a retrospective review of medical records in a regional tertiary care academic center in Korea. The rapid response team (RRT) was activated by electronic medical recording-based screening system by National Early Warning Score (NEWS) or by any health care providers. The team was composed of two critical care nurses and one critical care specialist per day, which running 16 hours a day from Monday to Friday.

Results: After RRS implementation, in-ward cardiopulmonary arrests was reduced from 5.4 to 3.4 per 1,000 hospital admissions (OR 0.677, 95% CI; p=0.02), which were the results of the seventeen months prior to the beginning of RRS and of the six months after. The average number of moderate or high risk patients classified by NEWS was 115.8 and 70.6 respectively per month. The average number of RRTs intervention for activated patients was 68.1 per month.

Conclusions: The implementation of RRS in a regional tertiary hospital was effective in reducing non-ICU cardiopulmonary arrests. This research also suggested that if the team was competent, operating small-staff RRT might improve ‘patient safety’ in a regional hospital with a high frequency of in-hospital cardiac arrest.

Keywords: Rapid response system, Region, Cardiopulmonary arrest
Table. Descriptions of Rapid Response Team Activations

<table>
<thead>
<tr>
<th>RRT activations from general words (n = 354)*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline characteristics of patients triggered activations</strong></td>
<td></td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>173</td>
</tr>
<tr>
<td>Medical patients, n (%)</td>
<td>147</td>
</tr>
<tr>
<td>Age, n (%)</td>
<td></td>
</tr>
<tr>
<td>Less than 40 yrs</td>
<td>22</td>
</tr>
<tr>
<td>more than 40 yrs and less than 50 yrs</td>
<td>16</td>
</tr>
<tr>
<td>more than 50 yrs and less than 60 yrs</td>
<td>34</td>
</tr>
<tr>
<td>more than 60 yrs and less than 70 yrs</td>
<td>57</td>
</tr>
<tr>
<td>more than 70 yrs and less than 80 yrs</td>
<td>100</td>
</tr>
<tr>
<td>more than 80 yrs</td>
<td>56</td>
</tr>
<tr>
<td>Major underlying comorbidity, n (%)</td>
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<tr>
<td>Solid cancer</td>
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<tr>
<td>Hematologic malignancy</td>
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<tr>
<td>Cardiovascular disease</td>
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<tr>
<td>Cerebrovascular disease</td>
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<tr>
<td>Chronic pulmonary disease</td>
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<tr>
<td>Renal failure</td>
<td>16</td>
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<tr>
<td>Trauma</td>
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<tr>
<td>Infectious disease</td>
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<tr>
<td>Post-op condition</td>
<td>28</td>
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<tr>
<td>Pregnancy</td>
<td>3</td>
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<tr>
<td>Endocrine disorder</td>
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<tr>
<td>Gastrointestinal disorder</td>
<td>5</td>
</tr>
<tr>
<td>Liver cirrhosis</td>
<td>6</td>
</tr>
<tr>
<td>Psychiatric disorder</td>
<td>1</td>
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<tr>
<td>Others</td>
<td>11</td>
</tr>
<tr>
<td><strong>RRT’s initial assessment for activation trigger, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Severe sepsis or septic shock</td>
<td>22</td>
</tr>
<tr>
<td>Respiratory distress or respiratory failure</td>
<td>179</td>
</tr>
<tr>
<td>Hypovolemia or dehydration</td>
<td>60</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>5</td>
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<tr>
<td>Arrhythmia</td>
<td>18</td>
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<tr>
<td>Anaphylaxis</td>
<td>5</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>5</td>
</tr>
<tr>
<td>Altered mentality or Seizure</td>
<td>5</td>
</tr>
<tr>
<td>Metabolic acidosis</td>
<td>1</td>
</tr>
<tr>
<td>Others or concern</td>
<td>72</td>
</tr>
<tr>
<td><strong>RRT Intervention for activated patients, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Airway management</td>
<td>71</td>
</tr>
<tr>
<td>Intubation</td>
<td>20</td>
</tr>
<tr>
<td>Oxygen supplement</td>
<td>46</td>
</tr>
<tr>
<td>EGDT</td>
<td>29</td>
</tr>
<tr>
<td>Vascular access and invasive monitoring</td>
<td>11</td>
</tr>
<tr>
<td>Hydration</td>
<td>11</td>
</tr>
<tr>
<td>Monitoring during intrahospital transport</td>
<td>4</td>
</tr>
<tr>
<td>Consultations for management or diagnosis</td>
<td>158</td>
</tr>
<tr>
<td>Recommend DNR(Do-not-resuscitate)</td>
<td>9</td>
</tr>
</tbody>
</table>

* No. of patients during six months (July to Dec, 2014) after the implementation of RRS
EVALUATION OF RISK FACTORS RELATED UNPLANNED EXTUBATION IN ADULT CRITICAL CARE

Kozue Suzuki, Kai Sigeno, Ryoko Asano, Rika Tokumine, Chikako Kawahara, Tetsuya Myojin
Tokyo Medical University Hospital, Japan

Background/Purpose: Unplanned extubation (UE) in patients with intensive care unit (ICU) potentially significant additive negative impacts. The relation between UE and ICU has been well recognized, however risk factors of UE have not well described. We therefore conducted a cross-sectional assessment for UE of risk factors in patients with ICU.

Methods: We compared five patients with UE and 841 Inserted ICU patients for one year period. Subjects underwent mean age, gender, APACH II score, length of ICU stay and ventilation, percentage of tracheotomy and emergency admission and mortality.

Results: Mean age (65.6 years in UE versus 63.3 years in Inserted ICU patients, P=0.73), Mean APACH II score was 18.8±5.11 in UE and 13.8±7.86 in Inserted ICU pts. Length of ICU stay (17.2±15.63 days in UE versus 4.16±5.52 days in Inserted ICU pts) and ventilation (15.0±17.25 days in UE versus 1.83±5.30 days in Inserted ICU pts) and emergency admission rate (4 patients in UE versus 203 patients Inserted ICU pts) were significantly different in patients with UE, all assessments are summarized in Table.

Conclusions: UE patients, as compared with normal intubated ICU patients manifested risk factor in UE risk in ICU patients. APACH II score is unhelpful in detecting UE risk in ICU patients with intubation. UE patients were more long stayed in ICU and had significant length of ventilation, emergency admission rate. Premorbid intellectual function, as assessed by the mortality was not significantly different.

Keywords: Unplanned extubation

<table>
<thead>
<tr>
<th></th>
<th>UE (n=5)</th>
<th>Inserted patients (n=841)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age,yr(±SD)</td>
<td>65.6 (±10.3)</td>
<td>63.3(±15.3)</td>
<td>0.73</td>
</tr>
<tr>
<td>Males,n(%)</td>
<td>4(80.0)</td>
<td>561(66.7)</td>
<td>0.53</td>
</tr>
<tr>
<td>APACH II score(±SD)</td>
<td>18.8(±5.11)</td>
<td>13.8(±7.86)</td>
<td>0.52</td>
</tr>
<tr>
<td>Length of stay in the intensive care unit,day(±SD)</td>
<td>17.2±15.63</td>
<td>4.16(±5.52)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Ventilation dates,day(±SD)</td>
<td>15.0(±17.25)</td>
<td>1.83(±5.30)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Tracheotomy,n(%)</td>
<td>1(20.0)</td>
<td>39(4.6)</td>
<td>0.11</td>
</tr>
<tr>
<td>Emergency admission,n(%)</td>
<td>4(80.0)</td>
<td>203(24.1)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mortality,n(%)</td>
<td>1(20.0)</td>
<td>26(3.1)</td>
<td>0.03</td>
</tr>
</tbody>
</table>
SUSTAINED IMPACT OF PRIMARY-TEAM-BASED RAPID RESPONSE SYSTEM ON THE ENTIRE HOSPITAL CPR RATE

Hsin Hui Hsu\(^1\), Maw Soan Soon\(^2\), Yu Jun Chang\(^3\), Chia Chu Chang\(^4\), Mei Hua Chen\(^5\), Kai Huang Lin\(^1\)

\(^1\)Section of Critical Care Medicine, Department of Internal Medicine, Changhua Christian Hospital, Taiwan, \(^2\)Vice Superintendent, Changhua Christian Hospital, Taiwan, \(^3\)Statistical Sciences and Epidemiology Program Center, Changhua Christian Hospital, Taiwan, \(^4\)Department of Nursing, Changhua Christian Hospital, Taiwan, \(^5\)Department of Internal Medicine, Changhua Christian Hospital, Taiwan

Background/Purpose: Many hospitals worldwide have rapid response system implantation. In view of Taiwan healthcare environment, an ICU-based team is not available everywhere. For the purpose of affinity, we try to set up a primary-team-based rapid response system in our hospital.

Methods: We implant the primary-team-based rapid response system in a 1738 beds medical center in Taiwan since 2010. The team in every specialty ward is made up of senior resident doctors, senior duty nurses, and acute care nurse practitioners who have received intensive care training. Similarly, our hospital has the standard processes for RRS trigger criteria and responses. The hospital RRS management committee was also organized to promote and supervise the system operations.

Results: After 5 years of effort, the average RRS trigger rate is around 21 times each month in every acute or chronic ward. The entire hospital CPR rate in wards for acute and chronic diseases has been reduced by 48.9% (3.9% vs. 1.99%, \(p<0.05\)). In addition, medical dispute cases have also displayed a downward trend. This being said, the overall in hospital mortality rate has not shown significant difference.

Conclusions: In previous clinical studies, the effectiveness of the rapid response team was controversial. Under cost considerations, it is difficult to allocate additional manpower to perform those works. Therefore, we tried to make structural modification due to the different environmental. In our experience of these five years, we found that traditional modes and small-scale change modes alike have a positive impact on improving the safety of patients.

Keywords: Rapid response system, CPR
THE IMPACT OF THE CRITICAL CARE OUTREACH TEAM BASED RAPID RESPONSE SYSTEM TO THE UNPREDICTED HOSPITAL DEATH

Masayasu Arai¹, Tomotaka Koike², Megumi Moriyasu², Sohei Ito³, Taito Inagaki⁴, Jun Hattori⁴, Tomohisa Otsuka³, Kazuhisa Yoshino³, Masayuki Kuroiwa³

¹Division of Intensive Care Medicine, Department of Research and Development Center for New Medical Frontiers, Kitasato University, School of Medicine, Japan, ²Division of Respiratory Care and Rapid Response System, Kitasato University Hospital, Japan, ³Department of Anesthesiology, Kitasato University, School of Medicine, Japan, ⁴Department of Emergency and Critical Care Medicine, Kitasato University, School of Medicine, Japan

Background/Purpose: Our hospital is an urban academic hospital which has 1000-bed. Since 2011, we started critical care outreach team (CCOT) based Rapid Response System (RRS) in our hospital. It is a multidisciplinary team which includes critical care physicians, nurses and physical therapists. The team provides the daily rounding to the patients who still requires the critical care after discharged from ICU. However, once the RRS is activated, the team responds to any type of the call. This is what we call CCOT based RRS. Our RRS include four typical components of RRS. The object of the study is to evaluate the impact of our CCOT based RRS system on unpredicted hospital death (UHD).

Methods: The medical records of the patients who admitted to the hospital from March 2009 to March 2014 were collected retrospectively. To examine the efficacy of RRS, the number of UHD (per 1000 admission per month) in Pre RRS period and Post RRS period were compared. UHD was defined as the case which the patients were attempted to resuscitate during cardiac arrest. Resuscitation related terms in the medical records were investigated as an evidence of resuscitation. Statistical comparisons were made by Mann-Whitney U-test for UHD.

Results: The total number of the patients who admitted to the hospital during 5 years was 109557 (Pre 50991, Post 58569). UHD in each phase was Pre RRS 0.58±0.54 vs Post RRS 0.30±0.4 (p=0.019).

Conclusions: CCOT based RRS system is effective for preventing the unpredicted hospital death.

Keywords: Rapid response team, Unpredicted hospital death
PREDISPOSING RISK FACTORS FOR DELIRIUM IN INTENSIVE CARE UNIT AFTER STENT GRAFT OPERATION

Yohei Kawatani, Yujiro Hayashi, Yujiro Ito, Hirotsgu Kurobe, Yoshitsugu Nakamura, Yuji Suda, Takaki Hori
Chiba-Nishi General Hospital, Japan

Background/Purpose: We aimed to evaluate the incidence and risk factors for delirium after endovascular stent graft placement as well as to investigate whether delirium impacts the length of ICU and hospital stay.

Methods: Consecutive patients who underwent elective endovascular stent graft placement during the period from October 2014 to April 2015 were enrolled. We retrospectively evaluated preoperative, intraoperative and postoperative status. The Intensive Care Delirium Screening Checklist (ICDSC) was used to diagnose delirium.

Results: A total 153 patients were enrolled. During the study period, delirium was diagnosed in 36 (23.4 %) patients after elective endovascular stent graft placement. At base line, patients who developed delirium were more likely to be older (76.3 +/- 10.3 years old vs. 69.8 +/- 9.7 years old). 69 patients underwent thoracic endovascular aneurysm repair and 84 patients underwent endovascular abdominal aneurysm repair. The length of ICU stay (3.69 +/- 3.3 days, p=0.002) and Hospital stay (14.8 +/- 10.2 days, p=0.024) for patients with delirium were significantly longer than for patients without delirium. Patients with delirium had a higher rate of preoperative renal insufficiency (42 % vs. 15%, p=0.001), preoperative benzodiazepine use (19 % vs. 8.5 %, p=0.069), intraoperative blood transfusion (16.7 % vs. 5.1 %, p=0.024) and a longer time of operation (163 +/- 64 minutes vs. 85 +/- 65 minutes, p<0.001).

Conclusions: Preoperative renal insufficiency, intraoperative blood transfusion, and longer operation time were risk factors for delirium in the ICU after endovascular stent graft placement. Delirium was associated with longer ICU and hospital stay.

Keywords: Stent graft, Delirium, ICU
PROPOFOL VS DEXMEDETOMIDINE FOR SEDATION IN PATIENTS WITH TRAUMATIC BRAIN INJURY

Oleg Tarabrin, Sergii Shcherbakov, Dmytro Gavrychenko, Ganna Mazurenko
Odessa National Medical University, Ukraine

Background/Purpose: It is known that propofol and dexmedetomidine decrease systemic blood pressure, heart rate, and cardiac output in a dose-dependent manner.

Methods: In the study, 84 patients with traumatic brain injury (Glasgow scale 7-8), mean age 44±13, 37 years, were included, all patients underwent mechanical lung ventilation. Patients were divided into 2 groups: in the 1st group (n=42), sedation was performed by intravenous propofol infusion at a dose of 4-12 mg/kg/h; in the 2nd group (n=42) sedation was carried out by intravenous infusion of dexmedetomidine at a dose of 0.2-1.4 mg/kg/h.

Results: 30 min after the start of sedation: in the 1st group HR-83±11,31 beats per min, BP-127±12, 87/64 ± 8,54 mm Hg, SpO2-97 ± 3,01%, in the 2nd group HR-87±10,01 beats per min, BP-131 ± 11,67/68 ± 8,19 mm Hg, SpO2-97 ± 2,98%. After 90 min: in the 1st group of patients, HR-81 ± 6,27 beats per min, BP-119 ± 11,46/59 ± 4,29 mm Hg, SpO2-98 ± 2,35%, in the 2nd group HR-82 ± 7,31 beats per min, BP-94 ± 13,62/55 ± 7,81 mm Hg, SpO2-97 ± 2,76%. 180 min after the start of sedation: in the 1st group HR-86 ± 6,19 beats per min, BP-105 ± 10,34/54 ± 4,28 mm Hg, SpO2-98 ± 1,32%, in the 2nd group HR-75 ± 6,27 beats per min, BP-92 ± 12,54/51 ± 6,91 mm Hg, SpO2-96 ± 2,91%.

Conclusions: Using of dexmedetomidine at a dose of 0.2-1.4 mg/kg/h for intravenous sedation is safe in terms of hemodynamics stability and blood oxygenation for sedation during mechanical lung ventilation in traumatic brain injury patients.

Keywords: Sedation, Brain injury
THE ALTERNATION OF VITAL SIGNS AND THE REQUIREMENT OF ANALGESICS AFTER DISCONTINUATION OF DEXMEDETOMIDINE IN POST-ESOPHAGECTOMY PATIENT ADMITTED INTO ICU

Daichi Fuijomoto, Moritoki Egi, Satoshi Mizobuchi
Kobe University Hospital, Japan

Background/Purpose: To observe the alternation of vital signs and the requirement of analgesics after discontinuation of dexmedetomidine in surgical ICU.

Methods: This is a retrospective study of 74 patients post-esophagectomy patients admitted to our ICU in 2012 and 2013. The ethics committee in our hospital approved this study to perform without patient consent. We collected vital signs including blood pressure, heart rate and respiratory rate at six points; one hour before discontinuation of dexmedetomidine, the point of discontinuation, and in 1, 2, 4, 6 hours after discontinuation. We also obtained the use of opioid and analgesic within 6 hours after discontinuation. We examined the alternation of vital signs using a one way repeated ANOVA test. P<0.05 was considered as a significant difference.

Results: The mean dose of dexmedetomidine was 0.28 μg / kg / hour at the time of discontinuation. Mean blood pressure, pulse rate, respiratory rate was significantly increased after DEX discontinuation (p <0.001, respectively). In compared with before discontinuation, the mean blood pressure increased by 13.3 mmHg, heart rate increased by 5.6 bpm, respiratory rate by 3.3 times / min in average at 6 hours after discontinuation. There were 43 patients (58%) that mean blood pressure increased more than 20 mmHg after discontinuation, and 28 patients (38%) who require the additional analgesia within 6 hours after discontinuation.

Conclusions: After discontinuation of dexmedetomidine, significant alternation of vital signs, especially on mean blood pressure was observed in post-esophagectomy patients. About 38% of them were required additional analgesia within 6 hours after discontinuation.

Keywords: Discontinuation, Dexmedetomidine, Surgical, Blood
ANALGOSEDATION FOR TARGETED TEMPERATURE MANAGEMENT

Yasuhiro Kuroda
Department of Emergency, Disaster, and Critical Care Medicine, Faculty of Medicine, Kagawa University, Japan

Background/Purpose: For avoiding complication with targeted temperature management (TTM), strict control of temperature was needed using analgosedation. However, method of analgosedation for TTM is not accepted widely.

Methods: The patients of post cardiac arrest syndrome, traumatic brain injury, and subarachnoid hemorrhage with TTM was selected for five years (Jan 1. 2010 to Dec 31, 2014) in our hospital. We examined the type of used analgesics, sedatives, and also examined the relationship between spices of analgosedation and TTM methods.

Results: For induction of TTM, avoiding dehydration with fluid resuscitation and vasodilatation to improve peripheral circulation is performed with fentanyl, dexmedetomidine, propofol, midazolam, muscle relaxant, and vasodilator using thermoregulation device. Avoiding high lactate value and metabolic acidosis is a key factor and shivering is diminished with different method by case. For maintenance phase with TTM, doses of analgosedation are decreased according to the duration of TTM. For rewarming phase, to avoid brain edema, analgosedation is carefully terminated.

Conclusions: For TTM, Analgosedation is different from universal PAD method.

Keywords: Targeted temperature management, Analgosedation
HIGH MORTALITY FROM BLOOD STREAM INFECTION IN ADDIS ABABA, ETHIOPIA, IS DUE TO ANTIMICROBIAL RESISTANCE: AN OBSERVATIONAL COHORT STUDY

Wondwossen Amogne Degu1, Teshale Seboxa1, Workabeba Abebe1, Tewodros Tsegaye1, Aklillu Azazh1, Workagegnhu Hailu1, Kebede Fufa1, Ayclign Derebe1, Nils Grude2, Thor Henrik Henriksen2

1Addis Ababa University, School of Medicine, Ethiopia, 2Vestfold Hospital Trust, Norway

Background/Purpose: We studied the importance of bacterial patterns and prevailing antimicrobial resistance in the outcome of blood stream infections at Addis Ababa, Ethiopia.

Methods: Clinical and laboratory characteristics of sepsis in 299 adult patients with two or more SIRS criteria were studied at Black Lion Hospital (BLH), Addis Ababa, Ethiopia. Distribution of bacterial species including their resistance pattern was studied from 166 pediatric blood culture isolates in the same hospital from cases of early/late neonatal septicemia and older children with sepsis. The blood culture results of 107 patients from Yekatit 12 Hospital Medical College were compared with those from BLH.

Results: Risk of death increased four folds when blood culture result was positive (44.7% vs. 10.3%, X2 = 33.0, p<0.0005). For patients with sepsis from Gram Negative Bacteria (GNB), survival depended on in vitro sensitivity towards third generation cephalosporins (8/10 vs. 1/10, X2=7.27, p=0.007). In the pediatric group, ceftazidime resistance was recorded in 64 (70%) of the 92 isolates. Co-resistance towards gentamicin, chloramphenicol, tetracycline and co-trimoxazole was recorded in ≥71% of ceftazidime resistant isolates. Ceftazidime-resistant GNB isolates were identified at both hospitals.

Conclusions: Proven sepsis, i.e. bacteremia in patients with two or more SIRS criteria has high mortality. Survival depends on antimicrobial sensitivity. Concomitant resistance towards third generation cephalosporins, gentamicin, chloramphenicol, tetracycline and co-trimoxazole were the rule not for one, but for all GNB species in this study. Multi-resistant GNB is either nosocomial problem shared between the two hospitals, or a community-wide problem at Addis Ababa.

Keywords: Sepsis, Antimicrobial, Resistance, Ethiopia, Addis Ababa
DAY3 VERSUS DAY1 DISSEMINATED INTRAVASCULAR COAGULATION SCORE AMONG SEPSIS PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

Sunghoon Park1, So Young Park2, Yun Su Sim3, Hyung Su Kim1, Joo-hee Kim1, Yong Il Hwang1, Seung Hun Jang1, Ki-suck Jung1

1Hallym University Sacred Heart Hospital, Republic of Korea, 2Kangdong Sacred Heart Hospital, Republic of Korea, 3Kangnam Sacred Heart Hospital, Republic of Korea

Background/Purpose: The role of disseminated intravascular coagulation (DIC) has not been extensively studied in sepsis patients.

Methods: A prospective study was performed in a single university hospital. The incidences of DIC at day1 (<24h of ICU admission) and day3 (48-72h) were investigated and compared among patients with sepsis. The ISTH criteria for DIC were used.

Results: Among 381 patients initially screened, 219 patients were finally enrolled in this study (mean age, 72.5 ± 12.0 years and female, 44.7%). Patients with septic shock and severe sepsis accounted for 62.6% and 21.0%, respectively (pneumonia, n = 110; urinary n = 51; biliary infection, n = 36). The incidence of overt DIC was 39.7% (n = 87) during the 72h. Patients with pneumonia sepsis had a lower day1 DIC score (P = 0.012) but they had a higher hospital mortality rate compared to those with nonpneumonia sepsis. In multivariate model, day3 DIC score (odds ratio, 1.748; 95% confidence interval, 1.115 2.738), not day1 score, was significantly associated with increased hospital mortality. By receiver operating characteristic curves, day3 DIC score had a better performance (area under the curve, 0.733; standard error, 0.044) for predicting mortality than day1 DIC score (0.617; 0.044); in particular, it performed better in patients with nonpneumonia sepsis than those with pneumonia.

Conclusions: Day3 DIC score, rather than day1 score, was the significant risk factor for hospital mortality and its performance might be better for patients with nonpneumonia sepsis than for those with pneumonia.

Keywords: Disseminated intravascular coagulation, Mortality
EMPIRIC ANTIBIOTIC THERAPY FOR SEVERE SEPSIS AND SEPTIC SHOCK

Waka Takahashi, Taku Oshima, Yosuke Hayashi, Shinya Iwase, Yoshiyuki Kodama, Takeo Kurita, Daiki Saito, Yoshihiro Yamaji, Shigeto Oda

Department of Emergency and Critical Care Medicine, Chiba University Graduate School of Medicine, Japan

Background/Purpose: We conducted a retrospective study to investigate the validity and the effectiveness of early empiric antibiotic and de-escalation therapy for the treatment of severe sepsis and septic shock patients at our ICU.

Methods: Patients admitted to our ICU from January 1, 2010 to December 31, 2012 for the treatment of severe sepsis or septic shock were selected for analysis.

Results: 110 patients were enrolled for the analysis. Carbapenems were selected most frequently (57.3%), followed by cephalosporins (22.7%) and penicillins (21.8%). Empiric antibiotic therapy was appropriate for 85 (77.3%) patients. Mortality rate for patients with inappropriate empiric therapy was 36.8%, where mortality rate for patients with appropriate empiric therapy was 17.5%. Among the patients with appropriate empiric antibiotic administration, de-escalation was associated with lower mortality rates of 5.0% for severe sepsis and 9.7% for septic shock patients. The mortality rates for the no de-escalation group were 19.0% and 35.7%, respectively.

Conclusions: Empiric antibiotic therapy was acceptable for severe sepsis and septic shock patients treated in our ICU. Appropriate selection of empiric antibiotic was related to the higher rate of de-escalation and better survival. Risk of multi-drug resistant bacterial infection was not as high as expected, but will need further attention in the future.

Keywords: Empiric antibiotic therapy, De-escalation, Severe sepsis
GLUCOSE-INSULIN-POTASSIUM THERAPY IN PATIENTS WITH SEPTIC SHOCK: A PILOT STUDY USING PROPENSITY SCORES

Won-young Kim, Young-shin Kim, Seunghee Baek, Jin Won Huh, Chae-man Lim, Younsuck Koh, Sang-Bum Hong

ASAN Medical Center, Republic of Korea

Background/Purpose: It is unclear whether patients would benefit from glucose-insulin-potassium (GIK) in the management of septic shock.

Methods: Septic shock patients who required vasopressors and were admitted to the intensive care unit were reviewed. Patients with or without GIK treatment were retrospectively compared by: (i) a crude analysis comparing baseline characteristics and outcomes and (ii) a propensity-matched case-control study adjusted for confounding by treatment assignment.

Results: A total of 214 patients were included in analysis. Among them, 45 patients received GIK, and 169 received standard care for septic shock. The median 72h vasoactive-inotropic score (VIS) was higher in GIK group (7 vs. 3; \( P = 0.01 \)), and the 28-day mortality also tended to be higher in GIK group (40% vs. 27%; \( P = 0.08 \)). The GIK group was more likely to have liver cirrhosis, need for mechanical ventilation and steroid, and had more need for renal replacement therapy than no-GIK group. In case-control study (39 patients in each group), the median 72h VIS (4 vs. 4; \( P = 0.80 \)) and 28-day mortality (39% vs. 36%; \( P = 0.81 \)) were similar between two groups.

Conclusions: GIK did not show an additive effect to standard care in patients with septic shock.

Keywords: Glucose, Insulin, Sepsis, Septic shock
<table>
<thead>
<tr>
<th>Table 1. Baseline characteristics, vasopressor types and dosages, and outcomes of the study patients</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>GIK group</strong></td>
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<tr>
<td><strong>(N = 45)</strong></td>
</tr>
<tr>
<td>Age, years</td>
</tr>
<tr>
<td>Male</td>
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<tr>
<td>Body mass index, kg/m²</td>
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<tr>
<td><strong>Comorbidities</strong></td>
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<tr>
<td>Diabetes</td>
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<tr>
<td>Hypertension</td>
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<tr>
<td>Ischemic heart disease</td>
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<tr>
<td>Chronic heart failure (NYHA I/II)</td>
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<td>Chronic obstructive pulmonary disease</td>
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<td>Chronic kidney disease</td>
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<tr>
<td>Liver cirrhosis</td>
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<tr>
<td>Solid cancer</td>
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<tr>
<td>Hematologic cancer</td>
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<td>Chemotherapy</td>
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<tr>
<td>Radiotherapy</td>
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<tr>
<td>Immunosuppressants</td>
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<tr>
<td>Immunosuppression</td>
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<tr>
<td>Postoperative state</td>
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<tr>
<td><strong>Severity of illness at ICU admission</strong></td>
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<tr>
<td>APACHE II score</td>
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<td>SOFA score</td>
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<tr>
<td><strong>Baseline values at ICU admission</strong></td>
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<tr>
<td>Temp, °C</td>
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<tr>
<td>Heart rate, /min</td>
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<tr>
<td>Mean arterial pressure, mmHg</td>
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<tr>
<td>Respiratory rate, /min</td>
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<tr>
<td>Glasgow Coma Scale (3-15)</td>
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<td>PaO₂/FiO₂</td>
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<tr>
<td>pH</td>
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<tr>
<td>Bicarbonate, mEq/L</td>
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<td>Sodium, mEq/L</td>
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<td>Potassium, mEq/L</td>
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<tr>
<td>Creatinine, mg/dL</td>
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<td>Hematocrit, %</td>
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<td>White cell count, /mm³</td>
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<td>Platelet count, /mm³</td>
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<tr>
<td>Total bilirubin, mg/dL</td>
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<td>Lactate, mmol/L</td>
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<tr>
<td><strong>Within 24h of ICU admission</strong></td>
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<tr>
<td>Mechanical ventilation</td>
</tr>
<tr>
<td>Renal replacement therapy</td>
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<tr>
<td><strong>Source of infection</strong></td>
</tr>
<tr>
<td>Pneumonia</td>
</tr>
<tr>
<td>Urinary tract infection</td>
</tr>
<tr>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td><strong>Vasopressor type</strong></td>
</tr>
<tr>
<td>NEpi alone</td>
</tr>
<tr>
<td>NEpi (and/or Epi and/or Dopa) + Vaso</td>
</tr>
<tr>
<td>NEpi (and/or Epi and/or Dopa) + Vaso + Dobu</td>
</tr>
<tr>
<td><strong>Hydrocortisone</strong></td>
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<tr>
<td>Norepinephrine equivalent dose, ug/min</td>
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<tr>
<td>VIS, median (IQR)</td>
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<tr>
<td><strong>Primary outcome</strong></td>
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<tr>
<td>72h VIS, median (IQR)</td>
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<tr>
<td><strong>Secondary outcomes</strong></td>
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<tr>
<td>28-day mortality</td>
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<tr>
<td>Vasopressor wean</td>
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<tr>
<td>Vasopressor-free days until day 28, days</td>
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<tr>
<td>median (IQR)</td>
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<tr>
<td>Ventilator-free days until day 28, days</td>
</tr>
<tr>
<td>median (IQR)</td>
</tr>
<tr>
<td>ICU stay, days, median (IQR)</td>
</tr>
<tr>
<td>Hospital stay, days, median (IQR)</td>
</tr>
</tbody>
</table>

GIK, glucose-insulin-potassium; NYHA, New York Heart Association; ICU, intensive care unit; APACHE, Acute Physiology and Chronic Health Evaluation; SOFA, Sequential Organ Failure Assessment; PaO₂, partial pressure of arterial oxygen; FiO₂, fraction of inspired oxygen; NEpi, norepinephrine; Epi, epinephrine; Dopa, dopamine; Vaso, vasopressin; Dobu, dobutamine; VIS, vasoactive-inotrop score.

*Data are presented as the numbers ± SD or percentages of patients unless indicated otherwise.
Table 2. Baseline characteristics, vasopressor types and dosages, and outcomes of the study patients: propensity-matched analysis

<table>
<thead>
<tr>
<th></th>
<th>GIK group (N = 39)</th>
<th>Control group (N = 39)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>64.4±13.0</td>
<td>65.7±11.6</td>
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<tr>
<td>Male</td>
<td>26 (67%)</td>
<td>29 (74%)</td>
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<tr>
<td>Body mass index, kg/m²</td>
<td>21.8±3.7</td>
<td>21.7±3.5</td>
<td>0.99</td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>12 (31%)</td>
<td>9 (23%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Hypertension</td>
<td>18 (46%)</td>
<td>14 (36%)</td>
<td>0.36</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>6 (15%)</td>
<td>5 (13%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Chronic heart failure (NYHA I/II)</td>
<td>2 (5%)</td>
<td>2 (5%)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>COPD</td>
<td>4 (10%)</td>
<td>6 (15%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>0</td>
<td>1 (3%)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Liver cirrhosis</td>
<td>7 (18%)</td>
<td>5 (13%)</td>
<td>0.53</td>
</tr>
<tr>
<td>Solid cancer</td>
<td>12 (31%)</td>
<td>13 (33%)</td>
<td>0.81</td>
</tr>
<tr>
<td>Hematologic cancer</td>
<td>5 (13%)</td>
<td>5 (13%)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>13 (33%)</td>
<td>14 (36%)</td>
<td>0.81</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>4 (10%)</td>
<td>4 (10%)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Immunosuppressants</td>
<td>6 (15%)</td>
<td>5 (13%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>19 (49%)</td>
<td>19 (49%)</td>
<td>&gt;0.99</td>
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<tr>
<td>Postoperative state</td>
<td>2 (5%)</td>
<td>4 (10%)</td>
<td>0.68</td>
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<tr>
<td>Severity of illness at ICU admission</td>
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<tr>
<td>APACHE II score</td>
<td>24.3±6.9</td>
<td>25.7±5.4</td>
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<tr>
<td>SOFA score</td>
<td>11.2±3.7</td>
<td>11.1±3.9</td>
<td>0.67</td>
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<tr>
<td>Baseline values at ICU admission</td>
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<tr>
<td>Temp, °C</td>
<td>37.6±1.4</td>
<td>37.5±1.1</td>
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<tr>
<td>Heart rate, /min</td>
<td>121.0±30.3</td>
<td>127.1±27.2</td>
<td>0.53</td>
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<tr>
<td>Mean arterial pressure, mmHg</td>
<td>60.6±8.7</td>
<td>58.3±8.7</td>
<td>0.23</td>
</tr>
<tr>
<td>Respiratory rate, /min</td>
<td>29.6±6.4</td>
<td>28.5±5.5</td>
<td>0.44</td>
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<tr>
<td>Glasgow Coma Scale (3-15)</td>
<td>6.9±5.0</td>
<td>7.0±4.4</td>
<td>0.58</td>
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<tr>
<td>PaO₂/FiO₂</td>
<td>171.8±98.1</td>
<td>163.1±91.1</td>
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<td>pH</td>
<td>7.34±0.10</td>
<td>7.32±0.12</td>
<td>0.50</td>
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<tr>
<td>Bicarbonate, mEq/L</td>
<td>20.5±7.2</td>
<td>20.1±6.6</td>
<td>0.99</td>
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<tr>
<td>Sodium, mEq/L</td>
<td>138.1±5.5</td>
<td>138.4±6.6</td>
<td>0.81</td>
</tr>
<tr>
<td>Potassium, mEq/L</td>
<td>3.8±0.7</td>
<td>4.1±0.7</td>
<td>0.08</td>
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<tr>
<td>Creatinine, mg/dL</td>
<td>1.8±1.1</td>
<td>2.0±1.8</td>
<td>0.87</td>
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<tr>
<td>Hematocrit, %</td>
<td>26.8±5.1</td>
<td>27.4±5.3</td>
<td>0.56</td>
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<td>White cell count, /mm³</td>
<td>14,169±15,044</td>
<td>15,700±13,102</td>
<td>0.37</td>
</tr>
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</table>
THE EFFECT OF EARLY GOAL-DIRECTED THERAPY ON OUTCOME IN ADULT SEVERE SEPSIS AND SEPTIC SHOCK PATIENTS: A META-ANALYSIS OF RANDOMIZED CLINICAL TRIALS

Jingyuan Xu, Yi Yang, Haibo Qiu
Zhongda Hospital, Southeast University, China

Background/Purpose: Our goal was to examine whether EGDT improved outcome when employed in the resuscitation of adult sepsis patients compared with control care by meta-analysis.

Methods: We searched for and gathered data from MEDLINE, Elsevier, Cochrane Central Register of Controlled Trials and Web of Science databases. Studies were eligible if they compared the effects of EGDT versus control care on mortality in adult patients with severe sepsis and septic shock. Data including mortality, sample size of the patients with severe sepsis and septic shock, and resuscitation endpoints were extracted.

Results: Eight studies compared EGDT with control care, and 3959 severe sepsis and septic shock patients were included. For patients with a higher severity of disease (acute physiology and chronic health evaluation score ≥ 20), EGDT reduced mortality significantly (RR 0.87; 95% CI, 0.77 to 0.99; p = 0.03) when compared with control care. Moreover, EGDT significantly reduced ICU mortality in severe sepsis and septic shock patients (RR 0.72; 95% CI, 0.61 to 0.85; p = 0.0002). Predefined subgroup analysis according to protocol with versus without ScvO2 suggested that mortality benefit appears with ScvO2 monitoring (RR 0.78; 95% CI, 0.66 to 0.91; p = 0.002) when compared with protocol including identical remaining intervention goals.

Conclusions: EGDT reduced mortality in septic shock patients with a higher severity of disease when comparing to control care.

Keywords: Sepsis, Septic shock, EGDT
THE CLINICAL SYNERGISTIC EFFICACY OF ANTITHROMBIN AND RECOMBINANT HUMAN SOLUBLE THROMBOMODULIN COMBINATION THERAPY FOR SEVERE SEPTIC DISSEMINATED INTRAVASCULAR COAGULATION

Keizo Ikemune1, Yoko Desaki1, Tasuku Nishihara1, Mikiko Takeuchi1, Hiromi Higaki3, Hironori Matsumoto2, Kenseki Umakoshi2, Kentaro Dote1, Toshihiro Yorozuya1, Takumi Nagaro1

1Department of Anesthesia and Perioperative Medicine, Ehime University Graduate School of Medicine, Japan, 2Department of Emergency Medicine, Ehime University Graduate School of Medicine, Japan, 3Division of Pharmacy, Ehime University Hospital, Japan

Background/Purpose: Antithrombin (AT) is recommended for disseminated intravascular coagulation (DIC) therapy in Japan. Recently, efficacy of recombinant thrombomodulin (rTM) has also been reported. Then we investigated the clinical synergistic efficacy of rTM and AT for septic DIC.

Methods: This retrospective study was conducted in Ehime University Hospital between September 2009 and December 2014 and included ICU patients with severe septic DIC. We compared the 2 groups; patients treated with rTM only and those treated with the combination of rTM+AT. The primary endpoint was 28-day mortality. The length of ICU stay, ventilator day, SOFA-CNS score (Sequential Organ Failure Assessment score without Glasgow coma scale) and DIC score change at 7 days were secondary endpoints.

Results: Out of the eligible 42 patients with septic DIC; 30 patients received rTM only and 16 patients received rTM+AT. There was no significant difference in the 28-day mortality between the two groups (rTM: 3/30 (10%), rTM+AT: 4/16 (25%), p=0.22). The length of ICU stay was also not significantly different (rTM: 18 day [10-32] [median [inter quartile range]], rTM+AT: 19 day [9.75-52], p=0.052). The rTM+AT group tended to require a longer ventilator day than the rTM group (rTM: 7.5 day [4.0-24.5], rTM+AT: 14 day [9-39], p=0.056). SOFA-CNS score reduction rate ((day1-day7)/day7) was -33.3% [-68.9-0.0] for rTM and -28.6% [-43.3--13.2] for rTM+AT, with no significant difference (p=0.72). There was also no significant difference in the DIC score reduction rate (rTM: -36.7% [-65.0--21.3], rTM+AT: -35.4% [-56.3--12.5], p=0.72).

Conclusions: The combination therapy of rTM+AT did not show a synergistic efficacy compared to rTM monotherapy.

Keywords: Sepsis, DIC, Thrombomodulin, Antithrombin
RECOMBINANT HUMAN THROMBOMODULIN (RHTM) IN PATIENTS WITH SEPSIS AND DISSEMINATED INTRAVASCULAR COAGULATION (DIC)

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Background/Purpose: Recombinant human thrombomodin (rhTM) was developed in Japan and has been widely used as an anticoagulant in patients with disseminated intravascular coagulation (DIC). In this study, we retrospectively assessed the efficacy of rhTM in our institution.

Methods: 120 patients received anticoagulant therapy because of sepsis-associated DIC between 2007 and 2012 in our intensive care unit. 50 patients (conventional group) were treated with antithrombin and/or synthetic protease inhibitor, and 70 patients (rhTM group) were treated with rhTM. We evaluated coagulation and inflammation data at day0 (before treatment) and day7 (7 days after the initiation of treatment) between conventional group and rhTM group. The resolution rate of DIC at day 7 and 60-day mortality were also evaluated between two groups.

Results: In the rhTM group, platelet counts and D-Dimer at Day 7 were significantly improved in comparison with those in the conventional group. The resolution rate of DIC at day 7 and 60-day mortality tended to improve in the rhTM group, but the changes were not significant. Cox regression analysis did not show that administration of rhTM was a significant predictor of 60-day mortality. During study period, bleeding complications were similar in both groups.

Conclusions: rhTM may be effective in patients with sepsis-associated DIC in terms of rapid improvement in coagulation data in comparison with conventional anticoagulants. However, mortality rate and resolution of DIC did not show significant changes in both groups. Further prospective trials are needed in the future.

Keywords: Disseminated intravascular coagulation, Recombinant human thrombomodin
EFFECT OF RECOMBINANT HUMAN SOLUBLE THROMBOMODULIN ON SEPTIC DISSEMINATED INTRAVASCULAR COAGULATION

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Background/Purpose: Septic disseminated intravascular coagulation (DIC) causes multiple organ dysfunction syndromes and must be controlled with the care of the original illness. In Japan, recombinant human soluble thrombomodulin (rTM) has been produced since 2008. This study was performed in order to investigate the efficacy and safety of rTM administration for septic DIC.

Methods: A retrospective study of 41 septic DIC patients in our ICU from August 2010 to March 2013 was performed. These patients were divided into two groups. The patients in the rTM group (n=32) were treated with rTM for septic DIC, and the patients in the non-rTM group (n=9) were treated without rTM. The blood samples were collected on day 0, when rTM or other anticoagulants were administrated, and on day 6, which was 6 days after rTM or other anticoagulants administration. The following parameters were discussed: Japanese Association for Acute Medicine-defined DIC score (JAAM-DIC score), SIRS score, platelet count, prothrombin time ratio, D-dimer, Sequential Organ Failure Assessment (SOFA) score, AT activity, side effect of bleeding, and mortality after 28 days.

Results: The severity of illness was similar in the two groups based on the SOFA score. The rTM group showed significantly improvement JAAM-DIC score, prothrombin time ratio, AT activity at day6 than day0 (p< 0.05). There were no differences between the two groups in the frequency of bleeding complications.

Conclusions: The rTM may be a safe and effective medical intervention for septic DIC.

Keywords: Recombinant human soluble thrombomodulin
ASSOCIATION OF NT-PROBNP WITH HEART RATE IN SEPsis PATIENTS

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Background/Purpose: Reportedly, N-terminal pro-B-type natriuretic peptide (NT-proBNP) elevation in sepsis patients has been associated with sepsis-induced myocardial dysfunction (SIMD) and poor outcome. Recent studies indicate rate control has significant effect for improvement in mortality of septic shock patients. However, no study has evaluated the relationship between hemodynamic profiles of sepsis patients and SIMD.

Methods: We enrolled all the patients who admitted to our intensive care unit in the University of Tokyo Hospital, NT-proBNP and neutrophil gelatinase-associated lipocalin (NGAL) measurement was conducted along with heart rate and rhythm recording on ICU admission. Tachycardia was defined as a heart rate >100 beats/min. In sepsis patients, we analyzed association of hemodynamic variables with the cardiorenal biomarkers (NT-proBNP and NGAL) using multivariate linear regression model and evaluated impact on 28 days mortality with Cox-proportional hazards model.

Results: A total of 222 patients were enrolled and 91 patients (41%) were diagnosed as sepsis. Of these sepsis patients, 46 patients presented tachycardia and 4 patients developed new onset supraventricular arrhythmia. In the sepsis group, tachycardia was one of the independent determinants of NT-proBNP elevation (p<0.05). Tachycardia tend to worsen survival rate in sepsis patients (HR 2.20 95%CI 0.78-7.06). Although NGAL showed significant elevation in sepsis patients (p<0.05), tachycardia was not significantly associated with NGAL elevation in the sepsis group.

Conclusions: In sepsis patients, tachycardia was significantly associated with NT-proBNP elevation and may have deleterious effects to cardiac function and prognosis.

Keywords: NT-proBNP, NGAL, Sepsis, Myocardial dysfunction

Table 1. Multivariate linear regression analysis for clinical determinants of NT-pro BNP in sepsis patients (N=91)

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>B</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>0.132</td>
<td>0.281</td>
<td>-0.106 to 0.668</td>
<td>0.152</td>
</tr>
<tr>
<td>Age</td>
<td>0.012</td>
<td>0.002</td>
<td>-0.024 to 0.027</td>
<td>0.901</td>
</tr>
<tr>
<td>CHD</td>
<td>0.377</td>
<td>0.911</td>
<td>0.444 to 1.378</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>APACHE II score</td>
<td>0.035</td>
<td>0.008</td>
<td>-0.042 to 0.058</td>
<td>0.756</td>
</tr>
<tr>
<td>SOFA score</td>
<td>0.098</td>
<td>0.044</td>
<td>-0.058 to 0.147</td>
<td>0.393</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>0.312</td>
<td>0.333</td>
<td>0.136 to 0.529</td>
<td>0.001</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>0.198</td>
<td>0.389</td>
<td>0.002 to 0.776</td>
<td>0.049</td>
</tr>
</tbody>
</table>

NT-pro BNP, N-terminal pro-B-type natriuretic peptide; APACHE, Acute Physiology and Chronic Health Evaluation; B, β, Unstandardized and standardized β coefficients, respectively; CI, Confidence Interval; CHD, Chronic Heart Disease; SOFA, Sequential Organ Failure Assessment; Tachycardia, Heart rate >100 beats/min on ICU admission.
**BUNDLE-BASED MANAGEMENT OF SEPTIC SHOCK IN NAGOYA UNIVERSITY EMERGENCY AND MEDICAL ICU**

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**Background/Purpose:** Since the Emergency and Medical ICU was opened in Nagoya University Hospital on 1st May 2011, we set up an original bundle containing underlying medical policies for the management of septic shock, because of high mortality rate of nearly 27% until 2010 at general ICU in our institute. This study is intended to verify the strategy.

**Methods:** As the basis for management of septic shock, 13 elements were combined as the management bundle of septic shock, which contained coupling usage of bactericidal antibiotics, standard precaution, early lactate clearance, early goal-directed infusion method, open lung strategy, analgesia and sedation, arterial waveform-guided dynamic monitoring, non-β-receptor stimulation, urine volume management, continuous hemofiltration, early enteral nutrition, protection of vascular endothelium, and early rehabilitation. We analyzed the feasibility and the outcome for septic shock from 1st May 2011 to 31st December 2014.

**Results:** Out of total 1,714 cases managed in our ICU among the period, 96 were included with septic shock. The sex ratio was 63:33. The mean age was 64.6±18.7 years old, mean ICU stay was 11.6±13.4 days. The mean APACHE II score was 28.6±7.8. The treatments were almost fully compliant at all elements. The 28 days mortality and in-ICU mortality was 8.3% and 7.3% respectively, regardless of 95.8% at shock withdrawal rate. The dominant causes of deaths were intra-abdominal infection, intestinal necrosis and soft tissue infection associated with DNAR order.

**Conclusions:** A higher survival rate was obtained than before in accordance with our management bundle.

Keywords: Septic shock, Management bundle, Mortality
STATINS INTAKE AND OUTCOME AFTER SEPSIS AND INFECTION: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED TRIALS

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Background/Purpose: Many researchers investigated the role of statins in patients with infectious diseases based on the hypothesis that stains may attenuate inflammatory response to infection via their pleiotropic properties. The objective of this study was to conduct an updated meta-analysis to evaluate the association between statin intake and the risk of infections and related outcome.

Methods: We searched PubMed, Embase, Web of Science and the Cochrane Central Register of clinical trials (from inception through August 2014) for published randomized controlled trials focused on statin intake for prevention and treatment of sepsis and infection. We also manually searched reference lists of relevant studies and meta-analysis to identify additional studies.

Results: 9 randomized trials were eligible for the inclusion criteria, 6 RCTs addressed the role of statins therapy in patients with infection, 3 RCTs addressed the role of statins in preventing infection. Pooled data showed that statins treatment was not associated with decreased in-hospital mortality (RR 1.10 [95%CI, 0.83-1.47]; P=0.50) and 28-day mortality (RR 1.10 [95%CI, 0.61-1.84]; P=0.72) in patients with infection; Pooled data showed that statin intake was associated with lower incidence of pneumonia (RR 0.81 [95%CI, 0.69-0.96]; P=0.02).

Conclusions: Our meta-analysis suggested that statins therapy was not associated with decreased mortality following sepsis and infection. However, we found that statins use is associated with a beneficial effect in preventing infection, highlighting a large multi-center randomized controlled trials is needed to confirm or refute the preventive effect of stains against sepsis and infection.

Keywords: Sepsis, Infection, Statins, Meta-analysis, RCTs
PREDICTIVE VALUE OF LACTATE CLEARANCE IN SEPTIC SHOCK PATIENTS

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Background/Purpose: To evaluate whether lactate clearance (LC) and central venous oxygen saturation (ScvO₂) can be a prognostic marker of mortality in patients with severe sepsis or septic shock undergoing early quantitative resuscitation.

Methods: We analyzed the sepsis registry for patients presenting to an emergency department. We included patients with simultaneous measurements of lactate and ScvO₂ at the time of presentation (H0) and 6 hours (H6) after enrollment. According to the LC and ScvO₂ (H6), the study population was divided into four groups. The good LC was defined as a LC of at least 10%. Patients with good LC and ScvO₂ ≥ 70% were assigned as group1. Patients with good LC and ScvO₂ < 70% were assigned as group2. Patients with bad LC, ScvO₂ ≥ 70% and ScvO₂ < 70% were assigned as group3 and group4.

Results: Of the eligible patients (363), we assigned 187 to the group1, 92 to the group2, 56 to the group3, and 28 to the group4. After adjusting for potential confounding factors, the adjusted OR for mortality was 1.25 (95% CI, 0.56-2.82; P = 0.75) in the group2, 3.80 (95% CI, 1.56-9.25; P < 0.01) in the group3 and 4.36 (95% CI, 1.50-12.64; P = 0.04) in the group4 compared to the group1. We developed another logistic regression model including LC and ScvO₂ (H6), instead of subgroup variable, and we found a significant correlation between good LC and mortality (adjusted OR, 0.27 (95% CI, 0.14-0.53; P < 0.01).

Conclusions: LC could be useful in predicting the outcome of patients with severe sepsis or septic shock undergoing early quantitative resuscitation.

Keywords: Lactate, Lactate clearance, ScvO₂, Sepsis, Mortality
WHICH IS THE BEST PREDICTIVE MARKER FOR DIAGNOSIS OF SEPSIS IN ICU PATIENTS, ENDOCAN, PRESEPSIN, PROCALCITONIN OR INTERLEUKIN-6?

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Background/Purpose: At the moment, we have few reports about the usefulness of endocan, presepsin (P-SEP), procalcitonin (PCT) and interleukin-6 (IL-6) as a diagnostic marker of sepsis in ICU patients. This study aimed to clarify which marker is more useful for diagnosis of sepsis and monitoring of severity in ICU patients.

Methods: This study conducted a single center retrospective study. Blood samples were collected from 64 patients who admitted in our ICU between April 2013 and August 2014. And we measured blood levels of endocan, P-SEP, PCT and IL-6 at day 1, 3, and 7 to determine a diagnostic marker for sepsis useful for higher-accuracy sepsis diagnosis. We also examined correlation between these biomarker levels and SOFA score at day 1, 3, and 7.

Results: Patients were divided into two groups. One was sepsis group (34 patients) and other was non-sepsis group (34 patients). We conducted ROC analysis for diagnosis of sepsis. The AUC of endocan, P-SEP, IL-6 and PCT were 0.661, 0.859, 0.835, and 0.865, respectively. In sepsis group, there were significant positive correlation between SOFA score and the levels of endocan (p<0.05, r=0.286), P-SEP (p<0.0001, 0.556), PCT (p<0.0001, r=0.435).

Conclusions: In this study we concluded that P-SEP was the most valuable biomarker for detecting of sepsis and evaluating of the severity of a patients illness.

Keywords: Endocan, Presepsin, Procalcitonin, Interleukin-6, Sepsis
EVALUATION OF RECOMBINANT HUMAN SOLUBLE THROMBOMODULIN THERAPY IN PATIENTS WITH SEVERE SEPSIS: COMPARISON BETWEEN SURVIVORS AND NON-SURVIVORS

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Background/Purpose: Whether recombinant human thrombomodulin (rTM) can improve the prognosis of septic DIC patients remains to be elucidated. In this retrospective study, we surveyed the rTM administration for severe sepsis, and compared the difference of the clinical course between survivors and non-survivors.

Methods: Severe sepsis patients who were admitted to our ICU from September 1, 2013 to May 31, 2014 and developed DIC were eligible. We used the DIC diagnostic criteria of the Japanese Association for Acute Medicine (JAAM). We examined 28 days mortality, the change of DIC score, the time interval between the diagnosis of DIC and the initiation of rTM, and the differences of these values between survivors and non-survivors.

Results: Among 45 severe sepsis patients, 17 patients received rTM therapy for DIC. The DIC score at 7 days was improved significantly compared to that of the first day (3[1-5] vs 5[5-8]). Mortality on the 28th days was 24% (4/17). While DIC score at 7 days in survivors was improved significantly compared to that of the first day (1[1-4] vs 5[5-6]), this value did not change in non-survivors (6[5-8] vs 8[7-8]). The time interval from DIC diagnosis to rTM administration was longer significantly in non-survivors than that of survivors (3[2-4] vs 0[0-1]).

Conclusions: These results suggest that the early administration of rTM was more effective, and the improved DIC score during one week after the initiation of rTM therapy could reflect the prognosis of septic DIC patients.

Keywords: Severe sepsis, DIC, Recombinant human thrombomodulin
THE ROLE OF NEUTROPHIL EXTRACELLULAR TRAPS IN PNEUMONIA SEPSIS

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Background/Purpose: Neutrophil extracellular traps (NETs) are structures composed of DNA and granular proteins, which rapidly trap and kill pathogens. The release of NETs has been identified as a novel immune response in innate immunity. But their role in pneumonia sepsis is unclear. We studied the role of NETs of plasma for the development of prognosis for adult patients admitted to ICU for pneumonia sepsis

Methods: We isolated neutrophils from patients with pneumonia sepsis admitted to the intensive care unit and healthy volunteer. We isolated neutrophils from community-acquired pneumonia patients on day 1 (PD1) and day 3 (PD3). Then we determined the ROS generation, NETs formation, surface expression of granule markers (CD63, CD66b, CD35; which are specific markers for azurophil granule, specific granule and secretory vesicle, respectively) and examine of signal transduction pathway

Results: Out of 22 patients with pneumonia sepsis, 12 (54.5%) were male; whose median age was 74.6 years. Median acute physiology and chronic health evaluation (APACHE) II was 26.3 and median SOFA 11.1 at admission. In the follow-up, 16(72.7%) patient survived at 28 days. Pneumonia sepsis group showed increased NETs formation, higher surface expression of CD63/CD66b whereas reactive Oxygen Species (ROS) generation decreased than healthy volunteer group. Survival group showed lower ROS generation and higher NETs formation than nonsurvival group. And we found that ERK, P38, PI3K pathway was increased in pneumonia sepsis group

Conclusions: NETs formed in pneumonia sepsis and survivor group showed higher NETs formation. Net formation could be a novel marker of heightened innate immune activation.

Keywords: Pneumonia, Sepsis, Neutrophil extracellular trap
CLINICAL IMPLICATION OF COMBINED BLOOD LACTATE AND CENTRAL VENOUS OXYGEN SATURATION IN PATIENTS WITH SEVERE SEPSIS OR SEPTIC SHOCK

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Background/Purpose: Blood lactate and central venous oxygen saturation (ScvO2) were known as representing markers to evaluate outcomes of patients with severe sepsis or septic shock. Prognostic value of combined lactate and ScvO2 has not been well elucidated. We evaluated the prognostic value of lactate combined with ScvO2 in patients with severe sepsis or septic shock.

Methods: 731 patients were diagnosed with severe sepsis or septic shock from prospective multicenter cohort study of 4,594 critically ill patients in 22 intensive care units from July 1 2010 to January 31, 2011.

Results: 368 (50.3 %) patients with severe sepsis or septic shock, whose both lactate and ScvO2 were measured, were evaluated. Mean age was 63 years old and the proportion of men was 37.7%. The numbers of group 1 (lactate<4 and ScvO2≥70%), group 2 (lactate<4 and ScvO2<70%, lactate≥4 and ScvO2≥70%), and group 3 (lactate≥4 and ScvO2<70%) were 168 (46.3%), 145 (39.9%) and 50 (13.8%), respectively. Group 2 and 3, compared to group 1, were significantly associated with 28-day mortality in multivariate analysis (Group 2 vs. 1, OR 1.874, CI 1.025-3.425, P=0.041; Group 3 vs. 1, OR 2.784, CI: 1.249-6.203, P=0.012). Overall 28-day mortality was 31.1%, them of each group were as follows and differed significantly: 24.2±4% in group 1, 43.4±4.6% in group 2, 60.1±8% in group 3.

Conclusions: Patients with severe sepsis or septic shock presenting with both lactate≥4 mmol/L and decrease of ScvO2 <70% within 24 hours had significantly the highest mortality than any other groups.

Keywords: Severe sepsis, Septic shock, Lactate, ScvO2
Figure 1. Survival curve of patients with severe sepsis or septic shock according to classification of lactate and ScvO₂

Group 1 vs. 2, P value < 0.001
Group 1 vs. 3, P value < 0.001
Group 2 vs. 3, P value = 0.023
CLINICAL EFFECTS OF LONGER DURATION OF POLYMYXIN B-IMMOBILIZED FIBER COLUMN DIRECT HEMOPERFUSION THERAPY FOR SEVERE SEPSIS AND SEPTIC SHOCK

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Background/Purpose: Polymyxin B-immobilized fiber column direct hemoperfusion (PMX-DHP) therapy is generally performed for 2 hours. This study analyzed septic shock patients who received PMX-DHP therapy for longer than 2 hours after responding poorly to 2 hours of therapy.

Methods: This retrospective study included patients who had undergone PMX-DHP therapy for longer than 2 hours because of a poor clinical response 2 hours after starting therapy. Pressure catecholamine index (CAIP = catecholamine index / mean arterial pressure; catecholamine index = dopamine + dobutamine + (adrenaline + noradrenaline) × 100μg/kg/min) was used as an indicator of hemodynamics. PaO2/FIO2 (P/F) ratio was examined in patients with concomitant sepsis-induced acute respiratory distress syndrome in order to evaluate pulmonary oxygenation capacity, and platelet counts and serum potassium levels were evaluated as indicators of safety.

Results: The subjects in this study consisted of 37 patients. The mean duration of PMX-DHP therapy was 15.8±7.9 hours, and none of the patients developed adverse events. CAIP and P/F ratio in the survival group significantly improved in the period between the start of and 24 hours after the end of PMX-DHP therapy, and post hoc analyses also showed that CAIP and P/F ratio in the survival group significantly improved in the period between 2 hours after the start of and end of therapy.

Conclusions: These results suggest that PMX-DHP therapy for longer than 2 hours can continue to improve the hemodynamics and pulmonary oxygenation capacity of patients with septic shock.

Keywords: Septic shock, Polymyxin B-immobilized fiber column direct hemoperfusion, Longer duration
PLASMA GLUTATHIONE REDUCTASE ACTIVITY IS WELL-CORRELATED WITH ERYTHROCYTE GLUTATHIONE REDOX RATIO AND IS ASSOCIATED WITH MORTALITY IN PATIENTS WITH SEPTIC SHOCK

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Background/Purpose: The erythrocyte reduced glutathione (GSH)/glutathione disulfide (GSSG) ratio is shown to be a sensitive parameter of antioxidant capacities. This study was performed to investigate whether plasma glutathione reductase (GR) activity is well-correlated with the erythrocyte GSH/GSSG ratio and is associated with the mortality of patients with septic shock.

Methods: We obtained blood samples from consecutive patients admitted to the EICU with septic shock through an arterial catheter at admission and 24 hours after admission. According to the 28-day mortality, patients were divided into the survivors and non-survivors.

Results: Of the 50 patients, 34 patients were the survivors and 16 the non-survivors. An increase in the Acute Physiology and Chronic Health Evaluation II (APACHE II) score for 24 hours after admission (odds ratio 1.401, 95% confidence interval: 1.078-1.802, p=0.012) and decreases in plasma GR activity (odds ratio 0.828, 95% confidence interval: 0.690-0.992, p=0.041) and the plasma selenium level (odds ratio 0.842, 95% confidence interval: 0.719-0.987, p=0.034) at 24 hours after admission were independently associated with an increase in the 28-day mortality of patients with septic shock. Furthermore, plasma GR activity was significantly correlated with the erythrocyte GSH/GSSG ratio (Spearman’s rho=0.367, p=0.009) and was negatively correlated with the plasma malondialdehyde level (Spearman’s rho= 0.424, p=0.002) at 24 hours after admission.

Conclusions: Plasma GR activity was well-correlated with the erythrocyte GSH/GSSG ratio and a decrease in plasma GR activity was associated with an increase in the mortality of patients with septic shock.

Keywords: Septic shock, Oxidative stress, Glutathione reductase
NEGATIVE CORRELATION OF SERUM INSULIN-LIKE GROWTH FACTOR 1 WITH CORTISOL AND RENIN LEVELS IN SEPSIS AND SEPTIC SHOCK

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Background/Purpose: Despite many prospective studies, sepsis is still one of the main causes of in hospital-death. Insulin-like growth factor 1 (IGF-1) is a hormone similar with insulin in molecular structure. It has anabolic effects and plays an important role in regulating of normal physiology as well as pathologic status. Previous studies showed patients with critical illness showed low serum level of IGF-1. We evaluated the IGF-1 level change in sepsis according to survival.

Methods: We evaluated 140 sepsis and septic shock patients (77 survivors and 63 non-survivors) who were admitted to the intensive care unit of a university-affiliated hospital in Korea. Serum levels of IGF-1 were measured on days 0, 1, 3, and 7. Patients with liver disease were excluded from this study. All data analysis was done by SPSS Version 20 (SPSS, Chicago, IL, USA).

Results: Patients with septic shock showed significantly low serum level of IGF-1 on day 1 and day 3 than non-septic shock patients (p = 0.002 and p =0.007, respectively). IGF-1 generally showed negative relationship with serum cortisol level, and it was significant on day 3 (p = 0.029). Furthermore, renin showed significantly negative relationship with IGF-1 on day 3 (p = 0.038). However, there was no significant difference in IGF-1 level between survivor and non-survivor.

Conclusions: Consistent with previous study, our results showed IGF-1 was associated with septic shock. However, IGF-1 level was not significantly different in survivor and non-survivor. Serum cortisol and renin level showed negative correlation with IGF-1.

Keywords: IGF-1, Sepsis, Survival
CLINICAL PROGNOSTIC FACTORS IN PATIENTS WITH SEPSIS ACCOMPANIED WITH MYOCARDIAL DYSFUNCTION

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Background/Purpose: Sepsis frequently accompanies myocardial dysfunction and much hormonal or metabolic derangement. Although some prognostic factors have been identified for survival in patients with severe sepsis, there has been few data about the prognostic markers in patients with sepsis-induced myocardial dysfunction, compared with the patients who have normal cardiac function in sepsis.

Methods: 101 sepsis patients who were admitted to the intensive care unit (ICU) of a tertiary referral center in Korea between 2008 and 2009 were included. Various clinical characteristics and laboratory markers were compared between the patients with normal cardiac function (ejection fraction (EF) ≥ 55%, n=84) and the patients with decreased contractility (EF< 55%, n=17). Then, the association between several laboratory markers (on day 0, 1, 3, and 7 after ICU admission) and the prognosis was analyzed in each subgroup.

Results: Only body mass index and the baseline N-terminal pro B-type natriuretic peptide (NT-proBNP) level were significantly different between two groups at the time of ICU admission (P=0.027 and P=0.001, respectively). In terms of 28 days mortality, there was no meaningful difference between two groups (P=0.804 by log rank test). However, when subgroup analyses were performed in each group, serum renin, aldosterone level on day 3, 7, and serum NT-proBNP, cortisol, glucagon, albumin on day 7 were significantly correlated with prognosis in normal EF subgroup. In contrast, serum cortisol level on day 0 was the only associated prognostic factor in decreased EF subgroup (P=0.021).

Conclusions: Early phase serum cortisol level is valuable in predicting mortality in patients with sepsis accompanied with myocardial dysfunction.

Keywords: Sepsis, Myocardial dysfunction, Prognosis

<Image 1>
1. Analyses for clinical and laboratory variables classified according to ejection fraction at the time of ICU admission in the patients with sepsis (n=101).

<table>
<thead>
<tr>
<th>Variables</th>
<th>EF ≥ 55 (%)</th>
<th>EF &lt; 55 (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td>62.4 ± 16.4</td>
<td>55.2 ± 17.8</td>
<td>0.119</td>
</tr>
<tr>
<td>Male (%)</td>
<td>49 (58.3)</td>
<td>12 (70.5)</td>
<td>0.346</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>23.6 ± 4.1</td>
<td>21.7 ± 2.8</td>
<td>0.027</td>
</tr>
<tr>
<td>Disease severity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septic shock</td>
<td>76 (90.5)</td>
<td>14 (82.4)</td>
<td>0.390</td>
</tr>
<tr>
<td>APACHE II score</td>
<td>20.1 ± 5.1</td>
<td>19.0 ± 6.2</td>
<td>0.403</td>
</tr>
<tr>
<td>SOFA score</td>
<td>8.2 ± 3.4</td>
<td>8.7 ± 4.2</td>
<td>0.834</td>
</tr>
<tr>
<td>Underlying diseases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>26 (31.0)</td>
<td>5 (29.4)</td>
<td>0.900</td>
</tr>
<tr>
<td>Chronic lung disease®</td>
<td>12 (14.3)</td>
<td>2 (11.8)</td>
<td>1.000</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>14 (16.7)</td>
<td>2 (11.8)</td>
<td>0.734</td>
</tr>
<tr>
<td>Hypertension</td>
<td>37 (44.0)</td>
<td>7 (41.2)</td>
<td>0.828</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>10 (11.9)</td>
<td>2 (11.8)</td>
<td>1.000</td>
</tr>
<tr>
<td>Laboratory values</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NT-proBNP</td>
<td>8440.0 ± 10902.4</td>
<td>19079.4 ± 13240.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Creatine, mg/dL</td>
<td>1.9 ± 2.0</td>
<td>2.1 ± 1.5</td>
<td>0.144</td>
</tr>
<tr>
<td>Cortisol</td>
<td>41.4 ± 35.4</td>
<td>35.6 ± 21.3</td>
<td>0.834</td>
</tr>
<tr>
<td>Remin</td>
<td>10.5 ± 12.2</td>
<td>9.8 ± 13.8</td>
<td>0.934</td>
</tr>
<tr>
<td>Aldosterone</td>
<td>147.4 ± 204.7</td>
<td>147.8 ± 230.8</td>
<td>0.525</td>
</tr>
<tr>
<td>Glucagon</td>
<td>96.2 ± 77.7</td>
<td>86.5 ± 59.4</td>
<td>0.832</td>
</tr>
<tr>
<td>IGF-1</td>
<td>75.2 ± 56.5</td>
<td>79.1 ± 57.1</td>
<td>0.836</td>
</tr>
<tr>
<td>CRP</td>
<td>19.6 ± 13.0</td>
<td>17.1 ± 17.8</td>
<td>0.465</td>
</tr>
</tbody>
</table>

ICU, intensive care unit; EF, ejection fraction; BMI, body mass index; APACHE II, Acute Physiology and Chronic Health Evaluation II; SOFA, Sequential Organ Failure Assessment; NT-proBNP, N-terminal pro B type natriuretic peptide; IGF-1, Insulin-like growth factor 1

a Data are presented as numbers (percentages) or means ± standard variation unless otherwise indicated.
b Chronic lung disease includes asthma, COPD, and structural lung diseases, such as bronchiectasis and interstitial lung disease.

(Table 1)
PROCALCITONIN AND OTHER INFLAMMATORY MARKERS IN PATIENTS WITH SEVERE SEPSIS AND SEPTIC SHOCK: A SINGLE CENTER EXPERIENCE

Abdulnasser Elzouki¹, Saibu George¹, Merlin Thomas¹, Sumaira Rafiqui¹, Karen Desouza², Muna Al Maslamani¹

¹Hamad Medical Corporation, Qatar, ²Mount Vernon Cancer Centre, United Kingdom

Background/Purpose: The purpose of this study was to determine the diagnostic value of serum procalcitonin (PCT), C Reactive protein (CRP) and White Blood Cells (WBC) as markers of sepsis in critically ill patients.

Methods: A retrospective analysis of the PCT levels and other inflammatory markers measured in 137 adult patients with a suspected diagnosis of sepsis and admitted to Internal Medicine inpatient service (i.e. medical wards and medical Intensive Care Unit) at Hamad General Hospital, Hamad Medical Corporation-Qatar during the period from January 2011 to December 2013 were included in the study.

Results: The serum PCT was measured by chemiluminescent immunoassay and the results were compared with other inflammatory markers between the patients with and without proven sepsis. A significantly higher PCT level was observed among patients with severe sepsis and septic shock compared to those without sepsis (19.34±5.63 and 25.91±6.29 vs. 4.72±2.57, respectively; p=0.02 and 0.01 by logistic regression analysis). No significant differences were found in CRP and WBC between these groups. Non-survivors of both septic and non-septic groups had a mean PCT level of 22.48±8.26 significantly higher than that measured in survivors of both groups (p=0.01), a difference not evident in other inflammatory parameters.

Conclusions: The results showed that PCT is a highly efficient inflammatory laboratory parameter for the diagnosis of severe sepsis and septic shock but WBC and CRP levels were of little value.

Keywords: Procalcitonin, Sepsis, Septic shock

<table>
<thead>
<tr>
<th>Table 1: Mean values of procalcitonin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Procalcitonin (ng/ml)</td>
</tr>
<tr>
<td>CRP (mg/l)</td>
</tr>
<tr>
<td>WBC (x10⁹/UL)</td>
</tr>
</tbody>
</table>
SURVEY ON SEPSIS CAMPAIGN IN HK

Poon Shing tak

China, Hong Kong Special Administrative Region

Background/Purpose: Sepsis is a serious health care condition and precipitated with high mortality. Sepsis management is an essential knowledge to critical care which includes medical & nursing management. Surviving Sepsis Campaign provides an international guideline for management of sepsis & shock which is the golden standard of critical care medicine. Clinical Consultative Working Group (former Education Committee) conducted a survey to investigate the sepsis management on ICUs in Hong Kong.

Methods: The survey was collected from 16 ICUs on different aspects on sepsis management. It included diagnosis, initial resuscitation, on-going supportive management, sedation management and infection control measure. The survey also investigated whether the decisions were made by medical staff/nursing staff under protocol/ or was a routine of ICU.

Results: The survey showed that most of the ICUs comply with the recommendations from the Sepsis Campaign. It is either driven by pure medical decision or nursing protocol.

Conclusions: In order to achieve an evidenced based practice in management of sepsis, the role of critical care nurse can be enhanced by actively participate in different stages of management of sepsis. Such as nurse directed weaning protocol is effective in reducing the duration of mechanical ventilation which also contributed to reducing the rate of ventilated associated pneumonia. To conclude, the Sepsis Campaign guidelines can provide an updated evidenced-based practice and to promote the best practice on caring patient with sepsis. In our way forward, doctors and nurses will discuss further on the related practice.

Keywords: Sepsis, campaign, Nursing protocol, ICU
THE ROLE OF CURCUMIN ON LIPOPOLYSACCHARIDE-INDUCED INFLAMMATORY CELL ACTIVATION AND ACUTE LUNG INJURY

Jeongmin Kim², Hyeonjeong Lee², Jia Song², Euna Jang³, Taehee Pyeon², Tran Duc TIN⁴, Sanghyeon Kwak¹

¹Chonnam National University Medical School, Republic of Korea, ²Chonnam National University Hospital, Republic of Korea, ³Chonnam National University Hwasun Hospital, Republic of Korea, ⁴Department of Biomedical Sciences, Chonnam National University Graduate School

Background/Purpose: Despite advances in the management of sepsis and acute respiratory distress syndrome, the mortality rate remains high. Over-activation of inflammatory cells involving macrophages and neutrophils are associated with multiple organ failure under those conditions. Thus, nontoxic molecules that regulate inflammatory cells may provide a novel therapeutic strategy. We evaluated the effects of curcumin in a murine model of LPS-induced acute lung injury. We also measured the production of TNF-α and MIP-2 and activation of ERK1/2, JNK, and p38 in RAW264.7 cells.

Methods: We evaluated the effects of curcumin in a murine model of LPS-induced acute lung injury. We also measured the production of TNF-α and MIP-2 and activation of ERK1/2, JNK, and p38 in RAW264.7 cells.

Results: Curcumin inhibited the production of TNF-α and attenuated phosphorylation levels of ERK1/2 and JNK, but not p38, in RAW264.7 cells stimulated with LPS. Curcumin also attenuated the production of TNF-α and the phosphorylation of ERK1/2 in the lungs of mice administered intratracheal LPS. Curcumin reduced the wet/dry weight ratio, histological severity, and neutrophil accumulation in the lungs and improved mortality after LPS treatment.

Conclusions: Curcumin attenuated LPS-induced lung injury by suppressing TNF-α production as well as ERK1/2 and JNK activation in macrophage stimulated with LPS.

Keywords: Acute lung injury, Cytokine, Lipopolysaccharide, Curcumin, Mitogen activated protein kinases
MELANOCORTIN RECEPTOR AGONIST BMS-470539 ATTENUATES LIPOPOLYSACCHARIDE-INDUCED NEUTROPHIL ACTIVATION AND ACUTE LUNG INJURY

Taehee Pyeon², Hyeonjeong Lee², Jeongmin Kim², Jia Song², Euna Jang³, Tran Duc TIN⁴, Sanghyeon Kwak¹

¹Chonnam National University Medical School, Republic of Korea, ²Chonnam National University Hospital, Republic of Korea, ³Chonnam National University Hwasun Hospital, Republic of Korea, ⁴Department of Biomedical Sciences, Chonnam National University Graduate School

Background/Purpose: Over-activation of inflammatory cells involving neutrophils are associated with multiple organ failure under conditions that sepsis and acute respiratory distress syndrome. Thus, nontoxic molecules that regulate inflammatory cells may provide a novel therapeutic strategy. This study was performed to evaluate the effects of melanocortin -1 receptor (MC-1R) agonist BMS-470539 on LPS-induced neutrophil activation and acute lung injury.

Methods: To assess the anti-inflammatory effect of BMS-470539 on LPS induced inflammatory cells activation, Neutrophils from mouse bone marrow were incubated with various concentrations of BMS-470539 (0, 1, 10 and 100 nM) and LPS (100 ng/ml). The protein levels for MIP-2 and TNF-α were measured using ELISA 4 hr after incubation period. We measured the levels of phosphorylation of MAPKs (p38, ERK1/2, JNK) with western blot analysis and NF-κB with EMSA 0.5 hr after incubation period. We examined the effect of BMS-470539 (20 mg/kg, IP) on acute lung injury and mortality of mouse treated with LPS (20 mg/kg, IP) to determine whether these effects of BMS-470539 also have in vivo.

Results: BMS-470539 inhibited the production of TNF-α and attenuated phosphorylation levels of ERK1/2 and p38 but not JNK in neutrophils stimulated with LPS. BMS-470539 also attenuated the production of TNF-α and the phosphorylation of ERK1/2 in the lungs of mice administered LPS. BMS-470539 reduced the wet/dry weight ratio, histological severity, and neutrophil accumulation in the lungs and improved mortality after LPS treatment.

Conclusions: BMS-470539 attenuated LPS-induced lung injury by suppressing TNF-α production as well as ERK1/2 and p38 activation in neutrophils stimulated with LPS.

Keywords: Acute lung injury, Melanocortin receptor agonist, Lipopolysaccharide, Cytokine, Neutrophil
PROGNOSTIC FACTORS OF PATIENTS WITH SEPTIC SHOCK IN THE EMERGENCY DEPARTMENT

Jin Joo Kim, Jong Won Kim, Young Su Lim, Won Bin Park, In Cheol Hwang
Gachon University Gill Medical Center, Republic of Korea

Background/Purpose: In this study, we check out independent key prognostic factors of patients who managed with septic shock in the emergency department.

Methods: This was a retrospective study through chart review of emergency medical records of all patients over eighteen years old who managed and hospitalized from emergency department with septic shock from January 2008 to September 2014 at one regional emergency center in South Korea.

Results: Of 648 patients admitted from ED during study period, 187 patients (28.9%) were dead. Factors associated with 30 days mortality in stepwise multiple logistic analysis were elderly patients (> 70 years) (adjusted odds ratio OR 2.24, 95% confidence interval CI 1.39-3.63), acute physiology and chronic health evaluation (APACHE) II (1.05, 1.03-1.08), leukopenia (white blood cell count < 4,000 /mm3) (2.91, 1.34-6.34), prolonged international normalized ratio (INR) over 1.2 (1.71, 1.06-2.76), hypoxemia (pO2 < 83 mmHg) (1.92, 1.09-3.40), lactate (> 4.0 mmol/L) (2.16, 1.31-3.56), pneumonia sepsis (2.73, 1.58-4.71), history of tuberculosis (3.04, 1.37-6.75), respectively. In secondary outcomes, lactate levels at arrivals in ED associated with the duration of ICU care among survivors from septic shock. (p < 0.001)

Conclusions: About 28.9% of patients with septic shock in one emergency center were dead, and several prognostic factors figured out by multiple logistic regression analysis including lactate levels at arrivals in ED over 4 mmol/ L. And also lactate levels associated with duration of ICU care among survivors. Further prospective studies would be needed for management of septic shock in ED.

Keywords: Septic shock, Prognosis, Emergency department
ANTIDEPRESSANT OR ANTIPSYCHOTIC OVERDOSE INTENSIVE CARE RESOURCE UTILIZATION IN A UNIVERSITY HOSPITAL

Palle Toft, Linda Borg, Anna Julkunen, Kristian Roerbaek Madsen, Thomas Stroem
Odense University Hospital, Denmark

Background/Purpose: It is often advised that patients who have ingested an overdose of antidepressants (AD) or antipsychotics (AP) are monitored with continuous ECG for minimum of 12-24 hours. These patients are often observed in an ICU. Our aim was to identify the number of patients with AD and/or AP overdose without adverse signs at hospital admission that turned out to need intensive care treatment. The effect of the antidepressants overdose risk assessment (ADORA) system was also evaluated. Our hypothesis was that the vast majority of these patients do not need intensive care treatment.

Methods: This retrospective study was conducted on adult patients admitted to the ICU at Odense University Hospital following an overdose with AP and/or AD between January 1st, 2009 and September 1st, 2014. Patients with predefined adverse signs in the emergency department were excluded due to obvious need for intensive care.

Results: Of the 157 patients included, 12 patients (8%) developed events during the ICU stay. Only 3 patients received intubation, vasoactive drugs and/or dialysis. No developed ventricular arrhythmias. There were no fatalities. All the patients with low risk assessment by ADORA except 1 did not develop events.

Conclusions: The vast majority of patients with AD and/or AP overdose and no adverse signs at admission did not require intensive care treatment. Low ADORA risk assessment may be indicative but does not guarantee the patients will not require intensive care treatment.

Keywords: Antidepressants, Antipsychotics, Intensive care
ORGAN DONATION RISE IN INDIA- A CHANGING TRENDS

Vijayanand Palaniswamy

G Kuppuswamy Naidu Memorial Hospital, Coimbatore, India

Background/Purpose: Organ donation is gaining momentum in India. A very few states in India have this noble cause working. Tamil Nadu stands first in the country with high organ donation rates. The government of Tamil Nadu started this program in 2008 and 620 organ donations has taken place. Coimbatore is a city of 2 million people and few hospitals do organ donations. Though the awareness was present the donation rate was very low related to disinterest and unawareness among the neurophysicians and intensive care specialist. G Kuppuswamy naidu memorial hospital started the program in 2006 but did not take up until 2014. We formed a team of ICU consultant and a donor coordinator. We identified and counselled patients with diagnosis of brain death and a higher conversion rate was noted. We have now the highest donation rate in the city and state among private hospitals.

Methods: A retrospective chart review of the patients who donated organs in our unit.

Results: A total of 23 patients donated organs from Feb 2014 to May 2015. The majority of donors are less than 25 years of age. Most of them are multi organ donors. All patients were confirmed brain dead using apnea testing. Ancillary testing like nuclide scan and CT angiography was used as an addit for better conversion rate among the multicultural population.

Conclusions: Organ donation is the need of the hour now in India. Better understanding and awareness among intensive care specialists will increase the donation rate. A country wide certification course for the trainees and specialists has to be introduced in near future.

Keywords: Organ donation, Private hospital, Ancillary testing
EARLY METABOLIC/CELLULAR RESUSCITATION AFTER SEVERE TBI: IMPACT ON CARDIOPULMONARY STABILITY AND ORGAN RECOVERY

Richard Blair Arbour
Lancaster General Hospital, United States

Background/Purpose: Cardiopulmonary instability following catastrophic TBI is consequent to multisystem effects of brain herniation. Delaying hormonal resuscitation (HRT) pending brain death declaration and consent for organ recovery causes significant delay between brainstem herniation and mechanism-based care for optimal organ function. This results in organ dysfunction and less favorable transplant outcomes. Early HRT dramatically improves cardiopulmonary stability. Project purpose was determining effectiveness of early metabolic/cellular-level resuscitation in a prospective series of patients following non-survivable brain trauma (TBI).

Methods: Ten patients following non-survivable TBI and apparent brainstem herniation were evaluated. Eight (80%) were supported prior to brain death (BD) declaration with maximal ventilation, volume resuscitation and inotropic/vasopressor dosing. Two patients (20%), received HRT using high-dose glucocorticoids, thyroid hormone replacement and vasopressin prior to brain death testing. Time-sensitive changes in cardiopulmonary responses were analyzed.

Results: Of 8 not receiving HRT prior to BD declaration, refractory hypotension occurred in 3 patients. One progressed to cardiac arrest with loss of all organs. In the two patients receiving early HRT, rapid improvement in oxygenation and cardiovascular parameters occurred, decreasing ventilation and vasopressor requirements. Formal BD protocols were completed, families consented and 8 total organs transplanted.

Conclusions: HRT initiated early in the care continuum was decisive, ethically sound, effective and easy to use mechanism-based care. Patients most likely to benefit from early HRT include those with apparent terminal brainstem herniation but too unstable for brain death testing. HRT is effective and appropriate for widespread use following catastrophic brain injury and apparent terminal brainstem herniation.

Keywords: Hormonal resuscitation, Brain death testing
CAR Diogenic Oscillation and Ventilator Autotriggering in Brain Death: Implications for Organ Donor Identification and Management

Richard Blair Arbour
Lancaster General Hospital, United States

Background/Purpose: Ventilator autotriggering may occur in brain-death from interaction between a commonly hyperdynamic cardiovascular system, high stroke volume and compliant lung tissue causing cyclic gas movement within the patient-ventilator system. When exceeding ventilator trigger sensitivities, ventilations may be misinterpreted as intrinsic respiratory drive, delaying brain death testing and losing transplantable organs. Purpose was to determine incidence of cardiogenic ventilator autotriggering in brain-dead patients analyzing impact on timing of brain death determination.

Methods: 26 patients following catastrophic brain injury and loss of neurological function were evaluated. Four (15%) had measured respiratory rate above ventilator set rate with confirmed loss of neurological function. Ventilator waveform analysis revealed oscillations in pressure and/or flow waveforms matching the cardiac cycle and exceeding ventilator trigger sensitivities. Ventilator trigger mode and sensitivity were optimized, eliminating autotriggering. Downloading ventilator data enabled retrospective analysis of waveform data in context with neurological findings.

Results: Cardiogenic autotriggering was confirmed in 15% of patients. Cardiogenic flow and pressure deflections measured 1.5–12.0 L/min and 1–9 cm H2O respectively. Hypertension and high stroke volumes were strongly associated with greater amplitude of cardiogenic oscillation and likelihood of autotriggering. Autotriggering ended immediately when flow and pressure trigger sensitivities were increased beyond cardiogenic waveform amplitudes.

Conclusions: Cardiogenic autotriggering may go unrecognized, delaying brain death determination, prolonging the ICU experience for families and restricting donor organ availability. Surveillance of progressive injury is integral to recognition of terminal brainstem herniation. Early recognition and patient-specific ventilator triggering prevent confusion regarding brain death and increase organ recovery.

Keywords: Cardiogenic oscillation, Ventilator triggering
RELATIONSHIP BETWEEN STRESS AND THE QUALITY OF LIFE AMONG THE RECIPIENTS OF THE LIVING DONOR LIVER TRANSPLANTATION

Hye Jin Yoo¹, Keum Soon Kim²

¹ASAN Medical Center, Republic of Korea, ²College of Nursing, Seoul National University, Research Institute of Nursing Science, Republic of Korea

Background/Purpose: This study was aimed to investigate the relationship between the level of stress and the quality of life among the adult recipients of living donor liver transplantation.

Methods: Participants were 213 outpatients who received living donor liver transplantation at least 3 months prior to this study. The recipients were aged 18 – 65 and had visited a general hospital in Seoul on a regular basis. Stress was measured using a modified version of the Kidney Transplant Recipient Stressor Scale (KTRSS), and the quality of life was measured using SF-36 version 2. Statistical processing was done with the SPSS WIN 18.0 program.

Results: The stress levels of the participants demonstrated significant differences according to the number of family members including the recipients themselves. The levels of quality of life exhibited significant differences according to the recipients’ sex, occupational conditions, families’ main sources of income, and the time since the liver transplantation. Stress and quality of life had an inverse correlation.

Conclusions: For the liver transplantation recipients, improving the quality of life is to be the ultimate goal of health-related mediation. Liver transplantation recipients would need to cultivate self-care ability to manage stress, and improving their quality of life.

Keywords: Liver transplantation, Stress, Quality of life
THE MANUFACTURE OF CUSTOM MADE 3D TITANIUM IMPLANT FOR SKULL RECONSTRUCTION

Kyu Won Shim, Eunkyung Park, Juseong Kim, Insik Yun, Dongseok Kim
Yonsei University College of Medicine, Republic of Korea

Background/Purpose: It is an inevitable challenge to deal with skull defect during neurosurgical procedures. It is a necessary challenge for the neurosurgeon. Calvarial reconstruction should provide not only biomechanical stability but also cerebral protection. It is well known that an autologous bone is the best choice of treatment, but sometimes it cannot be used, especially in cases of large defects.

Methods: Custom-made 3D titanium implant was manufactured using 3D CT data, Mimics software, and an EBM (Electron Beam Melting) machine. CT was scanned with 1mm thickness and the data was investigated from the bone part of axial, sagittal and coronal plane. After then, 3D image was produced and implant was designed for the defect. In designing process, the manufacturer and surgeon discussed the position of fixation, the amount of porosity and the figure of implant. When the manufacturing of the 3D implant was completed, the surgeon simulated the operation with it to the patients rapid prototyping (RP) model.

Results: Since the first case was implanted at Nov 2013, there were 9 patients so far. Most of them were underwent several operations for reconstruction of skull defect. The operation times were mostly less than 2 hours. There were no procedure related complications. The cosmetic results were extremely satisfied to patients.

Conclusions: Short operation time, exactly fitness to the defect and cosmetic outcome are advantages of this 3D printing method. In these aspects, custom-made 3D implants can be one of the best options for skull reconstruction.

Keywords: Skull defect, Syndrome of trephined, Cranioplasty
BLOOD VISCOSITY CHARACTERISTICS OF USING PROTHROMBIN COMPLEX CONCENTRATE VS FRESH FROZEN PLASMA IN PATIENTS WITH TRAUMA-INDUCED COAGULOPATHY

Oleg Tarabrin, Ivan Tyutrin, Oleg Chystikov, Ganna Mazurenko, Victoriya Ivanova, Pavlo Tarabrin

Odessa National Medical University, Ukraine

Background/Purpose: To compare the effectiveness of prothrombin complex concentrate (PCC) and fresh frozen plasma (FFP) in patients with multiple trauma, complicated with coagulopathy bleeding.

Methods: 51 patients with traumatic injuries divided into 2 groups: 1st group contained 26 patients as a treatment of coagulopathy received PCC in a dose of 25 IU/kg at time of admission to the ICU; 2nd group contained 25 patients received FFP in a dose of 15 ml/kg. Evaluation of the functional state of the hemostasis was carried out using low-frequency piezoelectric thromboelastography (LPTEG) on admission to hospital and 24 hours after the patients’ admission to the ICU.

Results: According LPTEG patients has abnormalities in platelet aggregation - Intensity of contact coagulation (ICC) was reduced by 27.51%, the coagulation - Intensity of coagulation drive was less then normal at 34.68%, clot maximum density was reduced by 75.16% and fibrinolytic activity - Index of retraction and clot lysis (IRCL) was 91.06% above the norm. In 1st group 24 hours after admission to ICU: ICC was reduced by 24.51%, compared to the norm; parameters of coagulation and fibrinolysis have reliable trend toward normal and decreasing the activity of IRCL reaches normal reference values. Patients of 2nd group have hypoagregation and hypocoagulation state with increased active of fibrinolysis. Clinically, patients of 1st group had reduced indicators of infectious complications, reducing term of mechanical ventilation, reducing the volume of blood transfusions.

Conclusions: The use of prothrombin complex concentrate can reduce the severity of pathological changes in the hemostatic system in patients with polytrauma

Keywords: Prothrombin complex concentrate, Fresh frozen plasma, Bleeding
TEN YEARS EXPERIENCE OF BLUNT SPLENIC INJURY AND FACTORS FOR TREATMENT PREDICTION

Gil Jae Lee, Byung Chul Yu, Min A Lee, Min Chung, Jung Nam Lee

Gachon University Gill Medical Center, Republic of Korea

Background/Purpose: Nonoperative management (NOM) for blunt splenic injury is now commonly practiced. The purpose of this study is to review of experience of treatment for blunt splenic injury and identify prognostic factors for failure of NOM.

Methods: This study was a retrospective review with blunt splenic injury between Jan. 2004 and Dec. 2013. All patients underwent contrast enhanced computed tomography. Total 247 patients were admitted, and we excluded below 15 year old patients.

Results: Total 207 patients were included. Mean age was 41.5 years, and male were 165 (79.7%). High grade injury (grade III, IV, V) consisted of 107 patients (51.7%), and 9 patients were treated with angioembolization. There were differences in systolic blood pressure, initial hemoglobin, platelet count, aPTT, lactate, transfusion of RBC and FFP. The mortality of NOM (3.1%) was lower than operative group (14.9%). Multivariate analysis showed that the spleen injury grading (high grade), level of aPTT and a transfusion of packed RBC were significantly related to operative management.

Conclusions: NOM for blunt splenic injury seems to be safe even in the high grade splenic injury. Injury grading scale and a transfusion of packed RBC were related with a treatment prediction. Further prospective studies are needed to draw a definitive conclusion.

Keywords: Spleen, Blunt injury, Nonoperative management
PREPERITONEAL PELVIC PACKING AS A SALVAGE TECHNIQUE TO CONTROL BLEEDING IN UNSTABLE PELVIC FRACTURE: PRELIMINARY RESULT

Ji Young Jang, Hongjin Shim, Pil Young Jung, Seongyup Kim, Keum Seok Bae
Yonsei University Wonju College of Medicine, Republic of Korea

Background/Purpose: In spite of multidisciplinary management for patients with unstable pelvic fracture, mortality remains over 40%. Current management algorithms for bleeding control include only angiembolization (AE) in the most of trauma center in Korea. However, because about 85% of bleeding due to pelvic fractures is venous or bony in origin, AE is often ineffective for bleeding control. In this study, authors introduce a preliminary experience about preperitoneal pelvic packing (PPP).

Methods: Eleven patients with hemodynamic instability due to pelvic fracture underwent PPP in Wonju Severance Christian Hospital between May 2014 and March 2015. The medical records of these patients were collected prospectively and analyzed.

Results: Median age was 59 years, and nine patients were male. Median systolic blood pressure before operation was 77 mmHg, and median lactate value was 4.17 mmol/L. Median injury severity score was 38, and lateral compression type in Young & Burges classification was most common. Emergency laparotomy and external fixation were performed concurrently with PPP in 3 patients (27.3%) and 5 patients (45.5%) respectively. Among 6 patients who underwent pelvic angiography, only 3 (50%) received arterial embolization. Median duration of PPP was 35 minutes, and median time for tape gauze removal was 57 hours. Median duration of ICU stay was 14 days, and two patients died.

Conclusions: PPP is effective in controlling hemorrhage from unstable pelvic fracture.

Keywords: Preperitoneal pelvic packing, Extraperitoneal pelvic packing

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Mechanism</th>
<th>Y-B type</th>
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<th>Embolization</th>
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EARLY OUTCOMES OF DAMAGE CONTROL SURGERY PATIENTS IN A NEWLY ESTABLISHED TRAUMA CENTER IN KOREA

Byungchul Yu, Jungnam Lee, Giljae Lee, Mina Lee, Jaejung Pak, Min Chung

Gachon University Gill Medical Center, Republic of Korea

Background/Purpose: Damage control surgery (DCS) improves outcomes when used in patients with severe hemoperitoneum. The aim of this study was to analysis patterns and indication of DCS in a single Korean institute, especially before and after trauma center establishment.

Methods: Twenty consecutive patients with unstable hemodynamics after initial resuscitation who had undertaken DCS for severe hemoperitoneum were retrospectively analyzed. Baseline characteristics, laboratory data, trauma scores and outcomes of the patients were reviewed using the data contained in medical record.

Results: The median age was 52.6 (IQR, 44.2-54.7) and 85% of patients was male. The median Injury severity score (ISS) was 30.5 (17-39.8). The overall survival rate was 40%, which was a little bit less than mean probability of survival (pS=0.4795).

Conclusions: DCS is widely used in trauma laparotomy and validated with improve outcomes. However, DCS was seldom used in our institute before trauma center establishment. In opposite, DCS was used in severe hemorrhage patients widely after trauma center establishment and improved outcomes.

Keywords: Trauma, Damage control surgery, Laparotomy
EARLY PREDICTION OF MASSIVE TRANSFUSION IN SEVERE TRAUMA PATIENTS WITH INITIAL HYPOTENSION

Yun Su Mun, Oh Sang Kwon, Seung Je Go, Toung Hoon Sul, Jin Bong Ye, Joong Suck Kim, Yeong Cheol Kim
Eulji University Hospital, Republic of Korea

Background/Purpose: Early prediction of massive transfusion is important in the management of major trauma patients. The purpose of this study is to determine the prediction factors of massive transfusion in severe trauma patients with initial hypotension.

Methods: A retrospective study was performed within the Eulji University Hospital. Review of trauma registry data identified 1074 major trauma patients (ISS, Injury severity score > 15). From January 2011 to December 2014, all major trauma patients with initial systolic blood pressure that was lower than 90 mmHg were included (N = 109). The patients were divided into two groups those who received massive transfusion (MT group) and those who didn’t receive massive transfusion (non-MT group) and the differences in initial values were compared between the two groups. Univariate analysis determined significant factors between those who received MT and those who did not.

Results: Out of a total of 109 patients, 42 patients were MT group and 67 patients were non-MT group. MT group had higher mortality than non-MT group (p=0.005). The data showed almost no difference in systolic BP, heart rate, RR, GCS, ISS, and BE between the two groups. The only statically significant factor was INR, MT group was higher INR than non-MT group (p=0.036, 1.30 vs 1.15).

Conclusions: From this study, the INR has demonstrated good predictability for MT in severe trauma patients with initial hypotension. Early aggressive resuscitation of the patients with initial prolongation of INR along specific guidelines is justified and may further improve outcome in severe trauma patients with initial hypotension.

Keywords: Major trauma patient, Massive transfusion
EFFECTS OF ACID-BASE BALANCE OF SEVERE TRAUMA PATIENT ON OXYGEN DELIVERY TO TISSUES

Byungho Choi, Eunseog Hong, Kyu-hyouck Kyoung
Ulsan University Hospital, Republic of Korea

Background/Purpose: Acid-base balance is essential for life support but as for these patients in critical condition including trauma, disturbance in regulation makes it hard to maintain homeostasis. In particular, pH has influences on an oxygen dissociation curve which affects not only hemoglobin oxygenation in lungs but also oxygen delivery to tissues. This study used a lactic acid, in order to understand how pH would affect oxygen delivery.

Methods: This was a retrospective study on trauma patients who recorded more than 15 scores of ISS and received ventilator care in ICU through an ER of the hospital in year 2014. The study worked on a mixed model to statistically analyze results of ABGA which had been carried out during the ventilator within and after 24 hours since the hospitalization.

Results: A total of 15 patients were included, and 12 of them were male. They were 51.5 years old on average, and the average ISS score is 27.7. The lactic acid within 24 hours since the hospitalization, this for pH appeared to be 9.64 ($P < 0.001$) while this other for oxygen saturation was gained as much as -0.08 ($P < 0.001$). The lactic acid after 24 hours, this for pH was observed to be 1.96 ($P=0.004$), but no relevance was noticed in connection with the oxygen saturation.

Conclusions: A rise in the lactic acid results from an increase in pH after 24 hours in severe trauma patients, and for adequate oxygen delivery to the tissues, the study suggests that alkalemia should be avoided.

Keywords: Trauma, Oxygen delivery, Lactic acid
CHANGE OF QUANTITATIVE D-DIMER VALUE AFTER TRAUMA MAY BE PREDICTIVE OF VENOUS THROMBOEMBOLISM IN CRITICAL CARE CENTER

Osamu Shigemitsu, Shinsuke Wada, Ryuichi Takenaka

Oita University Hospital, Japan

Background/Purpose: The venous thromboembolism is one of high risk complications in critical care center, regardless of doing several prophylactic methods. The risk of venous thromboembolism (VTE) is high (40~80%) after major trauma. We studied retrospectively diagnostic usefulness of the change of quantitative value of D-dimer (DD).

Methods: The new certain diagnosis of VTE after trauma were 7 patients from October 2012 to September 2014. VTE diagnostic strategy was based on the pretest clinical probability, DD assay as initial diagnostic test, followed by ultrasound, CT venography, and CT pulmonary angiography.

Results: DD level was 36.1 ± 12.1 mcg/ml at date of admission. After 3 days after admission, DD level was 6.4 ± 1.2 mcg/ml as minimum, and DD level was 31.9 ±10.7 mcg/ml at VTE diagnostic day. The increasing tendency of DD values >10 mcg/ml was observed in a case of VTE 4-7 days after admission. Two of 3 cases DD values >20 mcg/ml were needed insertion of IVC filter.

Conclusions: Change of quantitative DD after trauma may be predictive of VTE diagnosis and necessity of IVC filter.

Keywords: Venous thromboembolism, Trauma, D-dimer
ENDOVASCULAR REPAIR FOR TRAUMATIC THORACIC AORTIC INJURY: MID & LONG-TERM RESULTS IN A SINGLE CENTER

Jeong Won Kim, Yunseok Kim, Yong Jik Lee, Chang-ryul Park, Seong Hoon Choi, Soon Eun Park, Eun Seog Hong, Jong-pil Jung

Ulsan University Hospital, Republic of Korea

Background/Purpose: Blunt traumatic thoracic aortic injury is a life-threatening condition and the second most common cause of death trauma patients, after intracranial hemorrhage. Endovascular repair after traumatic thoracic aortic injury offers a less invasive alternative to open thoracic repair. We report our experience with stent grafts for treatment of this aortic injury.

Methods: A retrospective analysis of patients, who underwent thoracic endovascular aortic repair for traumatic thoracic aortic injury from July 2009 to March 2013 was conducted. Procedures were performed with standard endovascular techniques. Their characteristics were analyzed including associated injury, delays to diagnosis, early and long-term complications of endovascular repair.

Results: Fourteen patients underwent endovascular repair for traumatic thoracic aortic injury. Mean age was 46.8 years and 9 patients were male. Technical success was achieved in all cases without any conversion to open surgery. There was no thirty-day mortality and one late mortality due to heart failure after 2 months.

Conclusions: Thoracic endovascular aortic repair allows safe and effective treatment in patients with traumatic thoracic aortic injury. Mid and long-term outcome in these patients is excellent, whereas morbidity and long-term durability must be elucidated.

Keywords: Blunt trauma, Thoracic aortic injury, Endovascular repair, Outcome
PROGNOSTIC FACTORS INFLUENCING OUTCOME OF PATIENTS WITH NON-RESECTABLE LUNG CANCER ADMITTED TO THE INTENSIVE CARE UNIT

Jessica Lishan Quah, Yi Hern Tan
SingHealth Residency, Singapore

Background/Purpose: Admission of patients with non-resectable lung cancer to the intensive care unit is controversial due to the high mortality. With new anti-tumour therapies and improved prognosis, it is essential to evaluate if critically ill lung cancer patients now have better survival.

Methods: A 4-year retrospective single-centre review of 118 patients in Singapore with non-resectable lung cancer (non-small cell lung cancer = 99, small cell lung cancer = 19) admitted to the intensive care unit was performed. Baselines characteristics, tumour factors and extent of critical care support influencing the outcome of patients were analysed. Primary outcome evaluated was 90-day all-cause mortality.

Results: The mean (+/- SD) age of patients was 62.2 +/- 10.7 years. 67.8% were male and 83.9% of the patients were ethnic Chinese. 75% of the patients had ECOG-PS of 0-1. 43.2% had newly diagnosed disease while 47.5% had disease progression or recurrence. 59.3% of patients had prior anti-tumour treatment. Mean (+/- SD) APACHE was 18.7 (+/- 8.8) and 21.2% of the patients had pneumonia. 55.1% of the patients had respiratory failure and 28.8% had 2 or more organ failures. 7-day, 30-day and 90-day all-cause mortalities were 28.0%, 46.6% and 65.3% respectively. Multivariate analysis showed that prior anti-tumour treatment (p < 0.001) and presence of 2 or more organ failures (p < 0.002) were associated with increased 90-day all-cause mortality.

Conclusions: In patients with non-resectable lung cancer who had received prior anti-neoplastic therapy, or if 2 or more organ failures are present at ICU admission, limitation of care and early palliation should be considered due to poor outcomes.

Keywords: Lung cancer, Intensive care

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<Table 1>
SLEEP IN MECHANICALLY VENTILATED PATIENTS IN THE INTENSIVE CARE UNIT

Ebru Ortac Ersoy, Atila Kara, Serpil Ocal, Arzu Topeli
Hacettepe University Faculty of Medicine, Medical Intensive Care Unit, Turkey

**Background/Purpose:** Sleep abnormalities are common in critically ill patients. Sleep is highly fragmented and environment may not be optimal in ICU. The aim of this study was to monitor the sleep pattern in mechanically ventilated patients with polysomnography (PSG) who were admitted to our medical intensive care unit.

**Methods:** Patients with endotracheal intubation and mechanical ventilation for at least 24 hr were included in the study. All patients were receiving volume control ventilation during PSG. Sleep parameters were recorded. Using the APACHE II score was calculated on the day of admission. Medications and sleep records were obtained from the patient records on the day of PSG.

**Results:** There were 9 men and 3 women. Median age of patients was 72.5 years (min-max:31-92), APACHE II score was 19 (10-27), TST was 489.5 minutes (180-1105), sleep efficiency was 77.1% (24.9-96.5) and arousal number was 147.5 (14-450) per night. While REM sleep and Non REM stage 3 sleep time and proportion were found to be decreased (19.2%, 108.3 minutes vs 14.3%, 76.1 minutes respectively), Non REM stage 2 sleep time and proportion were increased (46.1%, 285.5 minutes). Daytime sleep were found most of our patients instead of night time. We could not find any correlation between time of sleep stages and APACHE II scores. And also there was not any correlation between nurse sleep records and recorded sleep time with PSG (p=0.580; r=0.178).

**Conclusions:** This study revealed that mechanically ventilated patients have changes in sleep architecture and they have severe sleep fragmentation.

Keywords: Sleep, Mechanical ventilation, Intensive care unit

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<th>Sleep recording time (min)</th>
<th>Sleep time(min)</th>
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PHASE ANGLE IN BIOIMPEDANCE ANALYSIS AND FLUID STATUS IN CRITICALLY ILL PATIENTS

Osamu Takasu¹, Keita Tashiro¹, Shuhei Niiyama², Takatoshi Kambe², Mikinori Kannaë¹, Mariko Moroki¹, Toshio Morita¹, Masakazu Nabeta², Atsuo Nakamura¹, Yoshihide Shimojo¹, Shinjiro Mori², Teruo Sakamoto¹

¹Department of Emergency and Critical Care Medicine, Kurume University School of Medicine, Japan, ²Advanced Emergency Medical Service Center, Kurume University Hospital, Japan

Background/Purpose: Hyperpermeability is a frequent complication in critically ill patients. Bioimpedance analysis (BIA) is an established non-invasive technique to assess body composition, nutritional status, and fluid status. Phase angle (PA), which is calculated from resistance and reactance in BIA, is considered to be an indicator of membrane integrity. However, it has not been elucidated whether the PA can explain the severity of hyperpermeability. The purpose of this study is to assess the PA values as the biological parameter in critically ill patients.

Methods: This study included 12 patients (median age 69) who were admitted to the ICU with an APACHE II score 31 ± 7. Nine of the 12 had sepsis. PA at 50kHz and fluid distribution (extracellular and intracellular water ratio, ECW/ICW) were determined with a Bioimpedance Analyzer at days 1, 2, 3, 5, 7, and 10 in the ICU. We analyzed the relationship between the PA and mortality, prognostic index, biochemical parameters, body weight (BW) and ECW/ICW.

Results: The median minimum PA in the first week was 4.72 in the total sample and smaller among the non-survivors (3.50, n = 3) than the survivors (4.98, n = 9). Logistic regression showed significant negative correlations between the minimum PA in the first week and APACHE II scores (r =-0.67), log-IL6 (r =-0.75), maximum BW change (BW/BW first day) (r =-0.64) and maximum ECW/ICW (r =-0.73) in the first week.

Conclusions: Our results suggested that PA is a predictor of mortality and can represent a valuable index of capillary leakage and the severity of hyperpermeability.

Keywords: Phase angle, Hyperpermeability, Bio-impedance
Figure 1

Figure 2

Poster Presentation
THE FEASIBILITY OF ALLEN COGNITIVE LEVEL ASSESSMENT ON PATIENTS WITH ACUTE RESPIRATORY FAILURE

Jae Young Moon¹, Sungju Jee¹, Cuk Seong Kim², Kwang-sun Suh², Ji Eun Park³, Gu-hyun An⁴, Min-jeong Kwon¹, Eungyoung Kang¹

¹Chungnam National University Hospital, Republic of Korea, ²Chungnam National University College of Medicine, Republic of Korea, ³Daejeon Veterans Hospital, Republic of Korea, ⁴Songdo Health Subcenter, Republic of Korea

Background/Purpose: Advancement in treatment of critical illness has resulted in reduced mortality, many of survivors have substantial cognitive impairments. However, the assessment of cognitive function level using MMSE or MOCA for critically ill patients might be limited. Allen Cognitive Level (ACL) was a tool for assessing the ability to perform visual-motor tasks through the application of cognitive skills such as deduction, planning, and problem solving. The aim of this study was to investigate the feasibility ACL assessment in adult intensive care units (ICUs).

Methods: This study was prospectively conducted at two adult intensive care units in a regional tertiary referral hospital between May, 2014 and Dec, 2014. Subjects were those who received mechanical ventilation due to acute respiratory failure for over 72 hrs, were functionally independent, neuropsychiatically normal prior to hospitalization. TMT and ACL assessment were done at three times, at just about weaning, and then at ICU discharge, finally at 1 week after ICU discharge. We evaluated the correlation of ACL with trail-making test (TMT).

Results: The number of subjects for analysis was thirty. Only ICU survivors were enrolled, whose severity score of APACHE-II was at least more than thirteen. The baseline characteristics were shown as <Table 1>. ACL score and TMT-A (number) percentile increased significantly over time (95% CI; p=0.001, and p=0.006, respectively). ACL score and TMT-A (number) percentile which at just about weaning showed significant correlation (95% CI; p=0.001, r = 0.492). There was significantly close correlation between ACL score and TMT-B (number -letter) percentile when evaluated at ICU discharge (95% CI; p=0.003, r = 0.569).

Conclusions: The Allen cognitive level was correlated with TMT which was sensitive to detecting cognitive impairment at ICU discharge. This study also suggested that ACL might be considered as one of the assessment tools of brain impairment for mechanically ventilated patients in adult intensive care units.

Keywords: Allen cognitive level, Acute respiratory failure
Table 1. Baseline Characteristics of Subjects

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<td>Sex, male n, (%)</td>
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<td>Age, mean (year)</td>
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<td>BMI</td>
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<tr>
<td>Length of stay, days</td>
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<tr>
<td>Length of stay in ICU, days</td>
<td>20.8 ± 15.7</td>
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<tr>
<td>APACHE-III</td>
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<td>Duration of mechanical ventilation days</td>
<td>174 ± 17.7</td>
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<td>TMT A (number) at just about wean, %</td>
<td>27 ± 5.1</td>
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<td>TMT B (number-letter) at just about wean, %</td>
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<td>Allen at just about wean</td>
<td>33 ± 1.2</td>
</tr>
<tr>
<td>PF ratio</td>
<td>2.03 ± 0.69</td>
</tr>
<tr>
<td>Lowest PF ratio within first 24hrs at ICU</td>
<td>2.14 ± 1.84</td>
</tr>
<tr>
<td>TMT A (number) at ICU discharge</td>
<td>194 ± 29.1</td>
</tr>
<tr>
<td>TMT B (number-letter) at ICU discharge</td>
<td>84 ± 22.5</td>
</tr>
<tr>
<td>ACL at ICU discharge</td>
<td>39 ± 0.9</td>
</tr>
<tr>
<td>TMT A (number) at ward after 7 days</td>
<td>325 ± 35.6</td>
</tr>
<tr>
<td>TMT B (number-letter) at ward after 7 days</td>
<td>239 ± 29.6</td>
</tr>
<tr>
<td>ACL at ward after 7 days</td>
<td>4.6 ± 0.77</td>
</tr>
</tbody>
</table>

*Figure 1*
RED CELL DISTRIBUTION WIDTH AS A PREDICTOR FOR MORTALITY IN ICU PATIENTS

Shinya Iwase¹, Masataka Nakamura¹, Tadanaga Simada¹, Daiki Saito¹, Shigeto Oda², Hiroyuki Hirasawa¹

¹Emergency and Critical Care Center, Eastern Chiba Medical Center, Japan; ²Department of Emergency and Critical Care Medicine, Chiba University Graduate School of Medicine, Japan

Background/Purpose: The objective of this study was to evaluate whether the red cell distribution width (RDW) is a significant predictor for hospital mortality in ICU patients.

Methods: A total of 291 patients were enrolled. We categorized the patients into quartiles based on RDW as follows: <12.5%, 12.5 to 13.1%, 13.1 to 14.0%, and ≥14.0%. Analyses included the association between RDW and mortality, correlation between RDW and lactate/interleukin-6 (IL-6)/Acute Physiologic and Chronic Health Evaluation II (APACHE II) score. The discrimination of RDW for mortality was assessed by the area under the curve (AUC) of receiver operating characteristic (ROC) curve.

Results: Hospital mortality was 7, 3, 11, and 29% in RDW <12.5%, 12.5 to 13.1%, 13.1 to 14.0%, and ≥14.0% groups, respectively. Mortality was significantly higher in RDW ≥14.0% group than the other quartiles groups (P < 0.001). RDW correlated significantly with lactate and APACHE II score (both P < 0.001), but not with IL-6 (P = 0.42). The ROC AUC showed that RDW has good discriminating power for hospital mortality (AUC = 0.71).

Conclusions: In ICU patients, an RDW on admission is a good predictor of mortality. RDW can be inexpensively and commonly measured in daily clinical practice. Therefore, RDW has the potential clinical utility to predict outcome in ICU patients.

Keywords: Red cell distribution width, Mortality, ICU
EARLY REALITY-ORIENTING ASSURING AND SLEEP ASSURANCE FOR DELIRIUM IN INTENSIVE CARE UNIT (ICU): A QUALITY IMPROVEMENT (QI) PROJECT; PRELIMINARY DATA

Seungyong Park, Hyunsun Kim, Yeonghun Choe, Sori Kim, Seoungju Park, Yongchul Lee, Dongchan Kim, Heungbum Lee
Chonbuk National University Hospital, Republic of Korea

Background/Purpose: Delirium is a global disturbance in cognitive function that is characterized by impaired attention associated with changes in the level of consciousness, disorganized thinking, and a fluctuating course. It occurs in up to 60∼80% of the ICU patients and has been associated with poor hospital outcomes, including increased morbidity, mortality prolonged length of stay and functional decline. We conducted the present study to assess the efficacy of reality-orienting assuring and sleep assurance for delirium prevention in ICU.

Methods: From March 2013 to September 2013, we retrospectively reviewed patients in surgical ICU of Chonbuk National University Hospital in Korea. The patients were stratified into pre- or post-QI groups according to whether the QI projects was applied or not. The primary end point was the incidence of delirium during ICU stays longer than 48 hs. Delirium was assessed using the Confusion Assessment Method for the Intensive Care Unit in intensive care patients and related the findings to the level of sedation, as assessed with RASS score daily.

Results: A total of 130 patients, 88 pre-QI and 42 post-QI patients, were assessed. The mean age of subjects was 56.6±18.6 (Pre-QI group: 56.9±19.2, Post-QI group: 55.9±17.5), and 54 (41.5%) was female. The mean ICU stay was 5.1±4.3 days (Pre-QI group: 5.1±4.5, Post-QI group: 5.1±3.9). The primary end point was decreased from 34.1% to 19.0% (P = 0.078), but was marginally significant.

Conclusions: We suggest that early reality-orienting assuring and sleep assurance appear to be a relatively effective preventive option for delirium in critically ill patients.

Keywords: Reality-assuring, Sleep assurance, Delirium, ICU
UTILIZATION OF A STANDARDIZED TRACHEOSTOMY CAPPING AND DECANNULATION PROTOCOL TO IMPROVE PATIENT SAFETY

Jimyoung Nam, Jinhee Jung, Heeog Lee, Sunyoung Won
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Background/Purpose: Criteria for tracheostomy tube decannulation and practical measures prevent failure. Protocol-guided decannulation decrease procedural complications and improve patient outcome and safety. Physicians requested evaluation for decannulation when underlying indication for tracheostomy had resolved. When tracheostomy capping consultation requested, advanced practice nurse (APN) was reviewed using tracheostomy capping screen checklist and had to go as protocol.

Methods: We reviewed the patient records of eight months applying the protocol. The main part of the protocol consisted of tracheostomy capping screen checklist, capping checklist, decannulation checklist. Criteria of tracheostomy capping screen checklist was consisted of tracheostomy tube- occlusion test, volume of pulmonary secretion, frequency of suction, cough effectiveness, etc. Upper airway can be checked noninvasively by fully deflating the cuff on tracheal tube and placing a gloved finger over the tracheostomy tube opening to deflect air through the upper airway and vocal cords, allowing phonation. Capping checklist included capping procedures, monitoring, preparations, education, emergency management.

Results: Ten patients were screened for a capping trial over a 8-month period; one patient had failed capping screen. 9 were capped. Eight patients passed the capping trial, and 8 were decannulated successfully. One patient who was too much secretions had failed capping trials. There were no complications of capping trials. Mechanical ventilation days, median (Standard Deviation[SD]) was 8 (5 to 10), tracheostomy days 25 (6 to 28), hospital length of stay 90 (47 to 170).

Conclusions: APN driven-standardized tracheostomy capping and decannulation protocol assisted in predicting successful decannulation and improve patient safety. Further studies are required for availability of more application.

Keywords: Tracheostomy, Capping, Decannulation, Patient safety
EXPERIENCE OF USING PASSY-MUIR VALVE IN ICU PATIENTS

Heeog Lee, Jinhee Jung, Jimyoung Nam, Sunyoung Won
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Background/Purpose: The Passy-Muir Valve (PMV) is a device using for tracheotomised patient in order to enable speech, improve swallowing, and reduce pulmonary aspiration. It has been also reported that the PMV can restore natural positive airway pressure, facilitate secretion management, and expedite ventilator weaning and decannulation. However, there are few studies of effectiveness of the PMV in Korea. Therefore, the aim of this study was to introduce a successful case of tracheotomised patient who was applied the PMV.

Methods: We reviewed medical records of nine patients who was applied the PMV from May to December 2014 at Samsung Medical Center. The PMV was applied to the patients who were alert mentally, stabilized in hemodynamics and over twenty years old. After suctioning, the cuff was deflated slowly. If no respiratory difficulty and sign of aspiration were observed, the PMV was connected between tracheostomy and circuit of ventilator. After the procedure, advanced practice nurse (APN) confirmed stable respiration and encouraged an expectoration of secretion.

Results: All patients could vocalize when the PMV was applied. No adverse events related with PMV were documented. Four of the nine patients were successfully decannulated. The mean duration of tracheal tube (TT) of four patients was 93.0±116.0 days and the PMV to decannulation was 67.3±111.2 days.

Conclusions: The use of the PMV in tracheostomized patients can provide verbal communication. Accordingly, it may have effects on decreasing of emotional problem such as isolation and depression due to the communication difficulty.

Keywords: Passy-Muir valve, Tracheotomised, Communication, Decannulation
PROTOCOLIZED SIMPLE BED-SIDE REHABILITATION FOR PATIENTS IN INTENSIVE CARE UNIT

Ryoungeun Ko, Seungyong Park, Yeonghun Choe, Seoungju Park, Sori Kim, Yongchul Lee, Dongchan Kim, Euiok Kwon, Yeonhee Choi, Heungbum Lee
Chonbuk National University Hospital, Republic of Korea

Background/Purpose: Although advances in critical care have resulted in increased population of survivors, many survivors experience post-intensive care syndrome (PICS). The aim of study was to investigate the benefit of protocolized simple bed-side rehabilitation (SBR) to prevent adverse intensive care unit (ICU) outcomes.

Methods: We projected SBR programmed 4 steps that consisted of stretching and hand grip, elevated shoulder and hip girdles, sitting by band, dangling and standing by bedside. Organizing team consisted of intensivists, physician, and nurse who performed intend treatment to ICU patients. The decision of exercise start and level up was made by two intensivists and one teaching nurse. The patients who have Glasgow Coma Scale under 12 points, receiving sedative agents, hemodynamic instability, brain death or surgical problem combined were excluded.

Results: In total, 108 patients were included and assigned by SBR (n=48) or non-SBR group (n=60). Baseline characteristics between the two groups were not significantly different. The hospital days were significantly shorter in SBR group in patients with APACHE II score under 20 (16.9±13.6 in SBR vs. 40.8±48.6 in non-SBR group respectively, p=0.040). Multivariate analysis showed that SBR was beneficial effect on patient ambulation. The number of patients who can walk at discharge was significantly higher in SBR than non-SBR group (52.9% vs. 23.7% respectively, p=0.010). However, mortality rate and duration of ICU length of stay or mechanical ventilation were not significantly different.

Conclusions: SBR appears to be an effective option for decreasing PICS in critically ill patients and can be simply performed without the assist of a rehabilitation specialist.

Keywords: ICU, Simple rehabilitation
Table 1. Comparison of Clinical and Laboratory Parameters Associated with Rehabilitation

<table>
<thead>
<tr>
<th></th>
<th>Rehabilitation group A (n=48)</th>
<th>Non Rehabilitation group B (n=60)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>35.46 ± 25.39</td>
<td>42.17 ± 37.47</td>
<td>0.291</td>
</tr>
<tr>
<td>Male sex, n</td>
<td>33 (68.75%)</td>
<td>37 (61.67%)</td>
<td>0.692</td>
</tr>
<tr>
<td>APACHE</td>
<td>21.41 ± 9.067</td>
<td>23.70 ± 8.22</td>
<td>0.179</td>
</tr>
<tr>
<td>Comorbidity, n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>17 (35.41%)</td>
<td>15 (25%)</td>
<td>0.243</td>
</tr>
<tr>
<td>Hypertension</td>
<td>30 (62.5%)</td>
<td>22 (36.6%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>9 (18.75%)</td>
<td>11 (18.33%)</td>
<td>0.956</td>
</tr>
<tr>
<td>Malignancy</td>
<td>7 (14.58%)</td>
<td>11 (18.33%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>10 (20.83%)</td>
<td>14 (23.33%)</td>
<td>0.759</td>
</tr>
<tr>
<td>ICU stay day</td>
<td>8.89 ± 7.92</td>
<td>9.22 ± 8.42</td>
<td>0.952</td>
</tr>
<tr>
<td>Hospital day</td>
<td>35.02 ± 25.31</td>
<td>42.64 ± 37.60</td>
<td>0.272</td>
</tr>
<tr>
<td>Death in 2 weeks</td>
<td>13.1 ± 10.22</td>
<td>11.8 ± 7.89</td>
<td>0.725</td>
</tr>
<tr>
<td>Walking discharge</td>
<td>20 (52.9%)</td>
<td>7 (23.7%)</td>
<td>0.010</td>
</tr>
</tbody>
</table>

The patients were analyzed from May 2014 to September 2014 who hospitalized MICU in Chonbuk University Hospital.

Patients with medical problem in May 2014 - September 2014. (N = 143, men = 105, women = 38)

Exclusion, n=34
1. Wrong id, n=7.
4. Hemodynamic instability n=15.

‘Linear exercise protocol’ Group A (N =48, men = 34, women = 14)
11 death in 2 weeks
Walking discharge: 20 patients of 38 ICU survivors

Non ‘Linear exercise protocol’ Group B (N =60, men = 36, women = 24)
13 death in 2 weeks
Walking discharge: 7 patients of 46 ICU survivors

< Figure 1 >
THE FEASIBILITY OF LIBERAL SAFETY SCREENING IMPLEMENTATION FOR EARLY MOBILIZATION IN MEDICAL INTENSIVE CARE UNIT

Jin Hee Jung, Soo Hyun Cho, Sun Young Won, Hee Og Lee, Seon Mi Kim, Yoon Mi Lee, Youngjun Ko, Jin Yeong Ko, Gee Young Suh, Chi Ryang Chung

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Early mobilization for critically ill patients has been recommended because of the positive effects on decreased hospital and intensive care unit (ICU) lengths of stay as well as a favourable physical prognosis. The strict safety screening criteria for ICU mobility might limit participating patients who need early mobilization. Therefore, the purpose of this study was to confirm the safety of mobilization in ICUs, which implemented measures beyond a usual safety screening tool.

Methods: Among the 355 patients admitted from February to April and June to August in 2014, 286 patients were screened by the strict safety screening tool on a daily basis. Beyond the safety criteria cases were discussions with a multidisciplinary rehabilitation team which consisted of intensivists, nurse practitioners and a physical therapist. The potential safety events and mobilization-related adverse events were recorded during the mobilization sessions.

Results: Among a total of 472 sessions, 128 mobilization sessions out of 54 patients beyond the usual safety screening criteria was conducted. Only 5 (3.9%) potential safety events occurred during the mobilization sessions which were implemented beyond the safety criteria of the screening criteria.

Conclusions: The potential safety events and mobilization related adverse events were not significantly increased during the mobilizations which were conducted beyond the usual safety criteria. Therefore, the safety screening criteria might be expanded in order to provide early mobilization to more patients.

Keywords: Early mobilization, Safety, ICU
THE EFFECTIVE WORKING SCHEDULE OF A PHYSICAL THERAPIST TO FACILITATE EARLY MOBILITY IN AN ENVIRONMENT OF LIMITED MANPOWER

Youngjun Ko, Seon Mi Kim, Jin Hee Jung, Soo Hyun Cho, Sun Young Won, Yoon Mi Lee, Jin Yeong Ko, Hee Og Lee, Gee Young Suh, Chi Ryang Chung

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Early mobilization for critically ill patients has become popular in order to decrease length of hospital stay and increase quality of life after being discharged. However, it has been difficult to treat enough patients due to a limited number of physical therapists (PT). The purpose of this study was to suggest an appropriate work schedule for PTs in Korean intensive care unit (ICU) environment.

Methods: During the quality improvement (QI) period, a dedicated PT worked in MICU from 8:30 a.m. to 12:30 p.m. In the post-QI period the PT schedule was divided into two sessions. The morning session ran from 10:00 a.m. to 12:30 p.m. and the afternoon session ran from 3:30 p.m. to 5:00 p.m. in the post-QI period. We reviewed the PT records of 277 patients who were admitted to MICU and investigated the mobility sessions and reasons for not implementing mobility.

Results: 215 (25.5%) mobility sessions during the pre-QI period and 285 (34.7%) sessions during the post-QI period were conducted. Out-of-bed mobility sessions have increased from 93 (11.0%) to 143 (17.3%) in the post-QI period. The changeable reasons for not implementing mobility were significantly decreased in the post-QI period from 177 (21.1%) to 125 (15.4%).

Conclusions: There was a significant increase in the total mobility sessions as well as out-of-bed mobility sessions after the PT schedule was divided. Therefore, the divided PT schedule was able to avoid a prior ICU intervention, such as various procedures, weaning trials and examinations, can be more effective with the limited PT manpower of Korean ICU environment.

Keywords: Physical therapist, Early mobility, ICU, Quality improvement

Table 1: Comparison of physical therapy sessions between pre-QI and post-QI period.

<table>
<thead>
<tr>
<th>Physical therapy</th>
<th>Pre-QI (n=830)</th>
<th>Post-QI (n=820)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not treatment</td>
<td>261(31.3%)</td>
<td>413(50.4%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Total in bed exercise</td>
<td>262(31.3%)</td>
<td>322(40.0%)</td>
<td>0.001</td>
</tr>
<tr>
<td>PROM</td>
<td>206(24.6%)</td>
<td>95(11.9%)</td>
<td></td>
</tr>
<tr>
<td>EMS</td>
<td>56(6.7%)</td>
<td>141(17.7%)</td>
<td></td>
</tr>
<tr>
<td>Automatic expander</td>
<td>0.0%</td>
<td>15(1.8%)</td>
<td></td>
</tr>
<tr>
<td>Total in bed mobility</td>
<td>122(14.5%)</td>
<td>142(17.3%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Reclining sitting</td>
<td>32(3.8%)</td>
<td>24(2.9%)</td>
<td></td>
</tr>
<tr>
<td>Independent sitting</td>
<td>43(9.9%)</td>
<td>106(13.2%)</td>
<td></td>
</tr>
<tr>
<td>High sitting</td>
<td>7(0.8%)</td>
<td>10(1.3%)</td>
<td></td>
</tr>
<tr>
<td>Total out of bed mobility</td>
<td>93(11.0%)</td>
<td>142(17.3%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Standing</td>
<td>49(5.8%)</td>
<td>70(8.6%)</td>
<td></td>
</tr>
<tr>
<td>Bed to chair training</td>
<td>10(1.2%)</td>
<td>50(6.0%)</td>
<td></td>
</tr>
<tr>
<td>Moving in place</td>
<td>222(26.8%)</td>
<td>46(12.5%)</td>
<td></td>
</tr>
<tr>
<td>Assisted walking</td>
<td>7(0.8%)</td>
<td>101(12.3%)</td>
<td></td>
</tr>
<tr>
<td>Independent walking</td>
<td>40(4.8%)</td>
<td>70(8.6%)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Values are mean are n (%). Abbreviation: QI, quality improvement; PROM, passive range of motion; EMS, electrical muscular stimulation.

Table 2: Comparison of changeable and unavoidable reason for not mobilized patients between pre-QI and post-QI period.

<table>
<thead>
<tr>
<th>Changeable reason</th>
<th>Pre-QI (n=24)</th>
<th>Post-QI (n=41)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other procedure</td>
<td>54(21.5%)</td>
<td>37(17.4%)</td>
<td></td>
</tr>
<tr>
<td>Weaning trial</td>
<td>23(2.9%)</td>
<td>7(0.9%)</td>
<td></td>
</tr>
<tr>
<td>Subjective decision</td>
<td>47(4.4%)</td>
<td>2(0.9%)</td>
<td></td>
</tr>
<tr>
<td>Ward transfer</td>
<td>55(6.8%)</td>
<td>57(17.4%)</td>
<td></td>
</tr>
<tr>
<td>Unavoidable reason</td>
<td>446(55.2%)</td>
<td>416(50.5%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Unavoidable reason</td>
<td>55(6.8%)</td>
<td>17(19.3%)</td>
<td></td>
</tr>
<tr>
<td>Refuse</td>
<td>33(3.9%)</td>
<td>10(12.2%)</td>
<td></td>
</tr>
<tr>
<td>Scrapping fluid</td>
<td>325(38.8%)</td>
<td>218(26.8%)</td>
<td></td>
</tr>
<tr>
<td>DNR</td>
<td>313(37.7)</td>
<td>17(2.1%)</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Values are mean are n (%). Abbreviation: QI, quality improvement; DNR, do not resuscitate.
FOUR-YEAR EXPERIENCE OF EXTRACORPOREAL MEMBRANE OXYGENATION FOR KIDNEY TRANSPLANTATION PATIENTS WITH SEVERE REFRACTORY CARDIOPULMONARY INSUFFICIENCY

Jongkwan Baek, Suk-kyung Hong

ASAN Medical Center, Republic of Korea

Background/Purpose: The ECMO is useful treatment modality for severe cardiac or respiratory decompensation. We review our patients who applied ECMO in KT recipients and assessed the role of ECMO support in these patients

Methods: During last 4 yrs, from December 2010 to December 2014, we had 11 patients who were supported from ECMO after KT in a single surgical ICU and reviewed the electronic medical record to get the patient information and outcome.

Results: The 11 patients (12 cases) of ECMO in patient with kidney transplantation were reviewed. Half of these cases were survived. The mean age of the 11 patients was 51.8 years (range 32-62) and seven of these were male. They got helped from ECMO 1 month to 15 years after their KT. Three of these cases got supported from ECMO while they were staying in hospital right after surgery and other nine of these cases were returned to hospital through the emergency room after their surgeries. In most cases, the respiratory failure is cause of ECMO (10 of 12 cases), seven of these were bacterial pneumonia, and the other three of these were combined viral and bacterial pneumonia. The other two cases applied ECMO due to fulminant pericarditis following cardiac failure and septic shock. This is the comparison between survivors and others. In pre-ECMO periods, the survivors had 3.6 days (others 6.0 days) of ventilator support, but these results is not statistically significant.

Conclusions: The use of ECMO can be the salvage treatment for kidney transplant recipients who have severe cardiopulmonary dysfunction.

Keywords: Extracorporeal membrane oxygenation, Kidney transplantation
APACHE II SCORE AND LACTATE LEVEL AS AN EARLY PROGNOSTIC MARKER OF MORTALITY IN CRITICALLY ILL PATIENTS

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¹Indonesian Society of Critical Care Medicine, Indonesia, ²Siloam Hospitals Lippo Village, Indonesia

Background/Purpose: APACHE II score and blood lactate measurements are frequently used to characterize disease severity and degree of organ dysfunction; however its use as a prognostic marker in predicting mortality remains uncertain. This study accuracy of both, APACHE II and lactate score in the Intensive Care Unit (ICU) in predicting mortality rate.

Methods: A retrospective cohort study was conducted in the Intensive Care Unit, Siloam Hospital Lippo Village, Banten, Indonesia, from January to December 2014. Patients of either gender with age > 15 years old for any cause were consecutively enrolled. Data was collected from 323 patients using a multivariate logistic regression.

Results: Out of 323 patients, 40 patients (12.38%) died. The cut-off value of lactic acid was found to be 4 (p-value < 0.001, OR= 4.686, CI 95%=2.236 -9.821) with an APACHE II cut-off value of 21 (p-value < 0.001, OR=8.941, CI 95% = 3.865 - 20.683). Multivariate logistic regression revealed in patients with APACHE II score of > 21 and lactate acid level > 4.0 mmol/L a predicted mortality rate of 48.32%.

Conclusions: The study concluded both APACHE II and lactate levels to be valuable early prognostic marker of mortality in critically ill patients.

Keywords: Lactate level, APACHE II, Mortality
A PROFILE OF CURRENT PHYSIOTHERAPY PRACTICES IN INTENSIVE CARE IN SOUTH AFRICA

Farhana Karachi¹, Susan Hanekom², Rik Gosselink³

¹University of Western Cape and Stellenbosch University, South Africa, ²Stellenbosch University, South Africa, ³Katholieke Universiteit Leuven, Belgium

Background/Purpose: Neither internationally nor locally have the profile, role and practices of intensive care physiotherapists been defined, but some evidence exists for the effectiveness of intensive care physiotherapy. No study has attempted to evaluate the profile, role and current practices of public sector intensive care unit (ICU) physiotherapists in South Africa (SA) particularly. The aim is to conduct a survey of the current profile, role and practices of physiotherapists in public sector ICUs in SA.

Methods: An electronic survey on general data, qualifications, training, work experience, workload, patient load, referral system, patient management, utilisation of protocols, discharge procedure and follow-up was used to collect data. All physiotherapy heads and respective physiotherapists offering services to public sector ICUs in SA were included. Descriptive data are currently being analysed.

Results: Preliminary results show that the majority of physiotherapists working in intensive care have BSc degrees, minimal postgraduate ICU training, increased workload, are not exclusively allocated to a unit, use very few protocols, if any, and do not have a standardised referral, discharge and follow-up service.

Conclusions: Preliminary results concur with international findings that there is variation in practice of intensive care physiotherapists in SA. This may have an effect on patient outcome in intensive care. Final conclusions will be drawn once all data analysis has been completed.

Keywords: Profile, Physiotherapy, Intensive care
ANALYSIS OF CHANGES IN MEDICAL CONSULTATIONS AT INTENSIVE CARE UNITS

Mi Kyoung Hong, Joohyun Park, Jeong Won Heo, Eunmi Gil, Tae Sun Ha, Dae-sang Lee, Jeong-am Ryu, Chiryang Chung, Jeong Hoon Yang, Jinkyeong Park, Joongbum Cho, Gee Young Suh, Chi-min Park

Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Background/Purpose: Even if an intensive care unit is cared by intensivists, it is recommended that they obtain advice from other professionals for specific fields. In this study, we analyze the trend of 8 years of medical consultation in the intensive care unit, and examined changes before and after implementing an intensivist care system.

Methods: We analyzed the retrospectively collected data about consultation in the medical, oncologic and surgical ICU from 2006-2013. Only cases that involved hospitalization for more than 48 hours were included. Requests to consultation clinics for examinations, radiologic procedure and approval for restricted antibiotics were excluded.

Results: A total of 11752 consultations were performed for 7754 patients. MICU performed an average of 1.7 consultations per patient and the consultations were most often related to infection specialist, neurology and rehabilitation, in that order. Oncology ICU performed an average of 1.36 consultations per patient, with specialists for infection specialist, neurology and nephrology consulted most often, in that order. In SICU, 3110 consultations were performed for 1998 patients (mean 1.55 cases). With 366 patients in a no intensivist group, consultations were requested for 45.9%, for an average of 1.52 consultations per patient, whereas consultations were requested for 47% of patients in the intensivist group, for an average of 1.33 consultations per patient. (p = 0.55).

Conclusions: Our results showed that intensive care units consult often with cardiology, infection internal medicine, pulmonology and rehabilitation departments.

Keywords: ICU consultation, Consultation trend
BEST-PRACTICE PROCESS OF IMPLEMENTATION STRATEGIES IN INTENSIVE CARE: A SYSTEMATIC REVIEW

Farhana Karachi¹, Susan Hanekom², Rik Gosselink³

¹University of the Western Cape and Stellenbosch University, South Africa, ²Stellenbosch University, South Africa, ³Katholieke Universiteit Leuven, Belgium

Background/Purpose: Various factors have been identified for the poor uptake of clinical guidelines and evidence based protocols in clinical practice, including uncertainty regarding effective implementation strategies. Implementation strategies that work in other clinical settings may not necessarily work in a setting as complex and dynamic as intensive care. While various implementation strategies have been investigated in ICU, this data has not been synthesized. Thus the best practice implementation strategies in ICU remain unknown and require further study.

Methods: In this systematic review Pubmed, Ebscohost (including Academic Search Premier, Africa wide studies, CINAHL, MEDLINE and Health Source: Nursing/Academic Edition), Web of Science, Scopus, Science Direct and Cochrane and Proquest Medical Library were electronically searched from inception of the databases up to and including the 31st March 2014. Only English, full text, randomized control, clinical control trials and interrupted time series studies were included. Data synthesis is still in progress.

Results: Nine out of 507 studies were finally included in the review. A combination of single faceted, multifaceted and active and passive dissemination strategies such as various educational outreach, audit and feedback, support, reminders and quality improvement teams and plans implementation strategies were the strategies described in the included studies.

Conclusions: Results thus far reveal that multifaceted implementation strategies are more effective than single strategies. It is not yet clear which combination of the specific strategies would be most effective in implementing change in intensive care practice. Further synthesis of the data may demonstrate the combination of strategies most effective for implementation of protocols in intensive care.

Keywords: Implementation, Strategies, Intensive care, Dissemination, Knowledge translation
INFECTIOUS COMPLICATIONS RELATED TO EXTRACORPOREAL MEMBRANE OXYGENATION IN ADULT PATIENTS

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Pusan National University School of Medicine, Republic of Korea

Background/Purpose: The extracorporeal membrane oxygenation (ECMO) use in adult patients has been increasing, but little is known about infections during ECMO.

Methods: We retrospectively analyzed the medical records of adult patients who received ECMO support for more than 48 hours at Pusan National University Yangsan Hospital from 2012 to 2014. Cases of bloodstream infection (BSI) and ventilator-associated pneumonia (VAP) that occurred in patients who received ECMO were analyzed.

Results: A total of 61 ECMO procedures were performed for more than 48 hours in 59 patients, and 19 patients had a total of 27 infections (37.3 infectious episodes per 1000 ECMO days). The infectious complications include 15 cases of BSI, of which 8 were in patients with VAP and 4 were in patients with catheter-related bloodstream infection (CRBSI) and 12 cases of VAP. Acinetobacter baumannii (31.6%) and Enterococcus faecium (26.3%) were in predominant blood isolates. The number of days of ECMO use was independently associated with a risk of infection (P=0.001). Infected patients had a higher intensive care unit (ICU) mortality and a longer ICU length of stay compared with uninfected patients (P=0.014 and P=0.023, respectively).

Conclusions: Our study showed infections during ECMO support occurred in 29.2% (21/72) of an adult population. The probability of infection increased with the duration of ECMO and the APACHE II score. Infections related to ECMO application affected the mortality and length of stay in ICU.

Keywords: Infection, Extracorporeal membrane oxygenation, Bloodstream infection, Ventilator-associated pneumonia
APPLICATION OF EJECTION-TYPE INTRAOSSEOUS INFUSION DEVICE IN CRITICALLY ILL PATIENTS IN THE PLATINUM 10 MINUTES

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First Hospital Affiliated to General Hospital of PLA, China

Background/Purpose: Bone marrow transfusion is a very mature technology. We proposed the Platinum 10 Minutes and use these measures in the first ten minutes at seven departments.

Methods: Clinical results of cardiopulmonary resuscitation and variety of shock rescue with the application of ejection-type intraosseous infusion device were analyzed in comparison to that with the conventional infusion methods. Intraosseous infusion was given thorough the following 6 locations: malleolus, upper side of the tibia, anterior (or posterior) superior iliac spine, distal radius, humeral head, and sternum.

Results: Total of 52 cases (36 male and 16 female; age ranged 23-75 y; 28 CPR, 18 shock resuscitation, 1 massive bleeding during a surgery, 1 end stage of tumor) was given ejection-type intraosseous infusion in ICU (39 cases), Emergency Room (9 cases), patients ward (3 cases), and a long-distance transferring vehicle (1 case). No bone fracture or other severe complications were found although liquid edema was observed in 2 out of 52 cases. Overall, 90.3% (47/52) patients were successfully given fluid resuscitation through the ejection-type intraosseous infusion device in the current trial. Failure of the 5 cases was due to either, improper operation (4 cases), or equipment failure (1 case).

Conclusions: Bone marrow infusion through intraosseous injection can be used not only in pre-hospital, but also in a hospital or even ICU, where a fast and reliable fluid resuscitation is required in order to achieve the best effect of resuscitation within platinum 10 minutes.

Keywords: Intraosseous infusion, Platinum 10 minutes, Ejection-type
PRELIMINARY STUDY ON THE RESPONSE TYPE OF RAPID RESPONSE SYSTEMS: RECOMMENDATION VS ACTIVATION

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The Catholic University of Korea, Seoul St. Mary’s Hospital, Republic of Korea

Background/Purpose: There are various operation ways of rapid response systems (RRS) depending on human resources and IT systems of each hospital. The study objective is to evaluate whether the operations of RRS are being properly in our hospital especially, in terms of response type.

Methods: Patients who were taken operations in the Orthopedics and received recommendation or activation response from RRS for 1 year were included. We use single parameter system as an early warning sign. The recommendation (group 1) is to give advices by telephone without activation when the patient was caught by computerized screening. The activation (group 2) is to go by the call or self-activation of RRS, manage the patient and give advices to the doctor.

Results: Numbers of group1 were 29 patients (M:F 10:19, mean age 68.0 years old) and group 2 were 30 patients (M:F 8:22, mean age 73.6 years old). There was the significant difference of APACHE II scores (10.1±3.42 versus 12.6±5.99, P=0.048), but not on the postoperative 1 day (P=0.801) between groups. There were significantly differences between groups in the MEWS on admission (1.58±0.04 versus 2.40±1.42, P=0.013) and on the activation time or recommendation time (3.27±1.30 versus 5.58±2.65, P < 0.001) but not on the POD#1 (P=0.367). Length of hospital stay and mortality were not significantly different between groups. But there is no unexpected CPR in group 1.

Conclusions: Recommendation is an effective response type with low MEWS. And interesting point was the relation between the MEWS on admission and response type.

Keyword: RRS
BODY MASS INDEX AS A PREDICTOR OF ACUTE KIDNEY INJURY IN CRITICALLY ILL PATIENTS

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Gyeongsang National University Graduate School of Medicine, Republic of Korea

Background/Purpose: Some studies suggest the existence of an obesity paradox in the intensive care unit (ICU). However, reports relating renal function and body mass index (BMI) are limited and controversial. This study aimed to examine the influence of BMI on acute kidney injury (AKI) in critically ill patients.

Methods: We retrospectively analyzed the collected data from patients admitted to the ICU at Gyeongsang National University Hospital in Korea from December 2011 to May 2014. Patients were stratified to three classes according to their BMI (underweight < 18.5 kg/m², normal 18.5-24.9 kg/m², and overweight ≥ 25 kg/m²). The occurrence of AKI was defined by risk, injury, failure, loss of kidney function, and end-stage kidney disease criteria, and the impact of BMI on AKI was analyzed.

Results: A total 468 patients in the ICU were analyzed, and AKI occurred in 82 (17.5%) patients. The mean BMI was 21.5 ± 4.0 kg/m²; 102 patients (21.8%) were classified as underweight, 286 patients (61.1%) were classified as normal, and 80 patients (17.1%) were classified as overweight. The adjusted analysis showed significantly higher risk of AKI in the overweight group compared to the underweight group (odds ratio, 3.95; 95% confidence interval, 1.749). Additional risk factors for AKI in critically ill patients included comorbid liver cirrhosis, septic shock, and ICU admission due to acute respiratory distress syndrome.

Conclusions: BMI is a possible predictor of AKI in ICU patients, as this study indicated that AKI occurs more frequently in overweight patients than in underweight patients.

Keywords: Body mass index, Acute kidney injury
PREDICTING ICU INTERVENTIONS IN INTENTIONAL DRUG OVERDOSE

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Background/Purpose: Many patients visiting the emergency department with intentional drug overdose are admitted to a medium care (MC) or intensive care unit (ICU) without ever requiring ICU interventions. To avoid patient burden and medical costs, it is important to identify at an early stage which patients will benefit from monitoring facilities.

Methods: We performed a retrospective cohort study among 255 cases of intentional overdose with drugs having potentially acute effects on neurological, circulatory or ventilatory function, admitted to the 12-bed ICU of the Deventer Hospital (450 beds) between 2007 and 2013. Interventions requiring MC/ICU admission included intravenous sedation, tracheal intubation, fluid resuscitation, treatment of convulsions, defibrillation, CVVH, or continuous administration of antagonists, vasopressors, inotropes, magnesium, calcium, atropine, or anti-arrhythmics. A decision model was developed to predict MC/ICU intervention, based on 9 criteria that could easily be identified in the emergency department (Table 1).

Results: Mortality in our cohort was 1/255 (0.4%). The average time spent on the emergency department was 2:45 h. Only 70/255 (27%) cases required one or more interventions. Using the decision model, 66/70 cases could have been predicted (sensitivity 94.3%) and 80/255 (31%) of admissions could have been avoided. Specificity of the model was 43.2% (Table 2). Estimated savings if the model had been used, ranged from $12,000 to $16,000 per year.

Conclusions: In patients with intentional drug overdose, using a simple decision model with 9 criteria that can be observed in the emergency department, MC/ICU interventions can be predicted. The model would have predicted 94.3% of interventions correctly.

Keywords: Emergency medicine, Toxicology, Health economics

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**Table 1**

<table>
<thead>
<tr>
<th>Criterion</th>
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<th>Prediction +</th>
<th>Prediction -</th>
<th>Total</th>
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<tbody>
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<td>66</td>
<td>105</td>
<td>171</td>
</tr>
<tr>
<td>P CO₂ ≤ 8.0 kPa</td>
<td></td>
<td>4</td>
<td>80</td>
<td>84</td>
</tr>
<tr>
<td>Respiratory rate ≥ 30/min</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic blood pressure ≥ 120 mmHg</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Systolic blood pressure ≥ 200 mmHg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glasgow coma score (EMV score) ≤ 14</td>
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**Table 2**

<table>
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<th>Prediction</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>94.3%</td>
<td>43.2%</td>
</tr>
<tr>
<td>-</td>
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</tbody>
</table>
THE RELATIONSHIP BETWEEN ANXIETY AND SLEEP DISTURBANCES IN RELATIVES OF PATIENTS WITH ACUTE PHYSIOLOGICAL STATUS CHANGES IN INTENSIVE CARE UNIT

Bekir Opus, Funda Gok, Alper Kilicaslan, Alper Yosunkaya
Necmettin Erbakan University, Meram Faculty of Medicine, Turkey

Background/Purpose: In relatives of patients staying in intensive care units (ICU), such changes as anxiety, depression, physical dysfunction, sleep disturbances and social isolation may be constituted (1). We aimed to determine the relationship between the changes seen in the physiological condition of ICU patients, and the common symptoms of the anxiety and sleep disorders witnessed in first-degree relatives of these patients, and to draw other health professionals attention to this issue.

Methods: Providing information to one 18-year-old and over first-degree relative of the patient hospitalized for at least 24 hours in ICU about the study, those accepting to give written consents were included into the study. Before the questionnaire, demodraphic data, Glascow coma scale, APACHE II scores (Acute Physiological and Chronic Health Evaluation) of all patients were recorded. The relatives were informed before participating into the study by the lecturer on patients’ status. The first survey was conducted the earliest 24 hours after the hospitalization, and the second survey was done 21 days after the admission. In the first application, State- Trait Anxiety Inventory (STAI), Pittsburgh Sleep Quality Index (PUKI) and in the second, only state anxiety scale and PUKI were performed. If the patient was discharged during this moment, the tests were done either during the discharge or within the first 24 hours in the clinic. If the patient was lost, the second part of the survey was completed by inviting the relative to the hospital or in patient’s home.

Results: After obtaining ethical approval, 47 patients’ relatives (26 men and 21 women) were included into the study. No difference was detected between TAI scores of patients’ relatives on 1st day while an increase was seen on 21st day as to STI scores, compared to those on admission. However, compared PUKI scores on 1st and 21st days, quality of sleep was determined to be distorted with time (p<0.05). Compared to PUKI-APACHE II scores, a positive correlation was detected on 1st day. A significant correlation was determined between APACHE II scoring and STI performed in patients’ relatives (p< 0.05). This correlation was more strongly seen on 21st day (r > 0.50).

Conclusions: An increasing relationship was determined between patients’ acute physiological condition and anxiety level as the time passed. However, while there was an association between acute physiological status and sleep quality at initial, the association was observed to disappear with time.

Keywords: Critical care, Anxiety, Sleep quality
Clinical Medicine - Sedation and Analgesia

CLINICAL EFFECTIVENESS OF THE UTILIZATION OF BUNDLED CARE FOR SEVERE SEPSIS AND SEPTIC SHOCK IN THAI CHILDREN: A MULTICENTER TRIAL

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Background/Purpose: Severe sepsis and septic shock are common conditions affecting live of infants & children worldwide. Initial resuscitation with surviving sepsis campaign is recommended for the first step in treatment of severe sepsis and septic shock. The utilize of SSC guideline was proved to reduce sepsis mortality. Thus this study is aim to use a modified sepsis bundle care to reduce sepsis mortality as a multicenter trial.

Methods: Infants and children aged between 1 month -15 years who were treated at 7 different sepsis centers including King Chulalongkorn Memorial Hospital, Siriraj, Ramathibodi, Vachira, Children’s hospital, Khonkaen University & Hadyai hospital who diagnosed with severe sepsis or septic shock from study period (January 2013- October, 2014) and met the inclusion criterias were recruited to the study.

Results: A total of 188 children with septic shock were enrolled during the study period. There were 108 male (57.4 %) and female 80 (42.6%). Their mean age was 111.5 ± 63.6 (month). 0.9% NSS was the most common type of fluid resuscitation & Dopamine was the most common inotropic drug used in this study. There were more than 80% of sepsis bundle compliance. The increased in compliance was started from 25% on the initial phase of the study and was increasing to more than 80% when the study passed the half way through. We also noted that each of sepsis component guideline had different impact on sepsis outcomes. The initial hemodynamic resuscitation is the most important element in our sepsis trial (P<0.01). Other sepsis treatments bundle such as the early use of vasopressor, the use of antibiotics also had an impact on our sepsis outcome.

More importantly, we found statistically significant reduction of our sepsis mortality from 42.6 ± 31.1% (pre-intervention) down to 17 ± 14.3 % (post-intervention) (P<0.001)

Conclusions: Our study demonstrated a significant reduction of our severe sepsis & septic shock mortality after implementing the modified 2-sepsis bundle care. Each of sepsis bundle element may have different effects on septic shock mortality. The increasing compliance to resuscitation bundle and treatment bundle could help in sepsis mortality reduction.

Keywords: Sepsis guideline, Septic shock, Thai children
EXTRACORPOREAL MEMBRANE OXYGENATION FOR REFRACORY ACUTE RESPIRATORY DISTRESS SYNDROME IN MILIARY TUBERCULOSIS

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¹Kosin University Gospel Hospital, Republic of Korea, ²Seoul National University Bundang Hospital, Republic of Korea

Introduction: Acute respiratory distress syndrome (ARDS) is caused by a variety of lung injuries and consequently, hypoxemia often occurs despite adequate oxygen therapy. It can rapidly progress to respiratory failure with refractory impairment of gas exchange, which is often unresponsive to rescue therapies. Protective lung ventilation has saved many patients, but it can eventually lead to ventilator-induced lung injury (VILI). Therefore, other, additional treatment methods are required. Extracorporeal membrane oxygenation (ECMO) aids in the recovery of pulmonary function during ARDS. In this report, we present the case of a patient with pulmonary tuberculosis and ARDS who was initially treated with advanced critical care in an intensive care unit, but failed to improve.

Case: We present the case of a 44-year-old female patient with pulmonary tuberculosis and ARDS who was initially treated with advanced critical care in an intensive care unit, but failed to improve. To prevent further VILI and respiratory failure with the occurrence of pneumothorax, we started ECMO support to maintain oxygenation and ventilation. From then on, the patient improved gradually and survived. However, inevitably, we couldnt avoid not only VILI, but also anticoagulation problems, low serum levels of anti-TB drug due to sequestration in circuit, over 80 days of mechanical ventilation.

Conclusions: This case suggests that ECMO relieves ARDS and can allow the lungs to rest, while maintaining acceptable oxygenation and ventilation, but ECMO can also accompany various clinical complications of long-term critical care.

Keywords: Tuberculosis, Extracorporeal membrane oxygenation
Figure 3: Timeline of clinical events during 73 ECMO days.
ACUTE RESPIRATORY DISTRESS SYNDROME AS THE INITIAL CLINICAL MANIFESTATION OF AN ANTISYNTHETASE SYNDROME

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Inje University Seoul Paik Hospital, Republic of Korea

Introduction: Antisynthetase syndrome has been recognized as an important cause of autoimmune inflammatory myopathy in a subset of patients with polymyositis and dermatomyositis. It is associated with serum antibody to aminoacyl-transfer RNA synthetases (anti-Jo1) and is characterized by a constellation of manifestation, including fever, myositis, interstitial lung disease, mechanic’s hand like cutaneous involvement, Raynaud phenomenon, and polyarthritis. The lung disease is the presenting feature in 50% of cases. We report a patient with an antisynthetase syndrome, revealed by an acute respiratory distress syndrome (ARDS).

Case: The patient described in the present case study was a 60-yr-old female, and she was admitted to hospital for ARDS and diagnosed with anti-Jo-1 antibody positive polymyositis (antisynthetase syndrome). The patient’s condition improved when she was given high-dose corticosteroids. She was successfully weaned from the ventilator on day 11 after intubation.

Conclusions: We think that given that steroids are not greatly beneficial in the treatment of ARDS, it is likely that the improvement of the respiratory symptoms in this patient also resulted from the prompt suppression of the inflammatory systemic response by corticosteroids.

Keywords: Acute respiratory distress syndrome, Antisynthetase syndrome, Anti-Jo-1 antibody
EARLY EXTRACORPOREAL MEMBRANE OXYGENATION FOR MASSIVE ASPIRATION DURING ANESTHESIA INDUCTION

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Introduction: Although its incidence is not high in general surgical population, pulmonary aspiration of gastric contents can result in serious long-term morbidity and mortality.

Case: A 64-year-old woman was scheduled for total gastrectomy. Midnight Nil per Os was carried out before the operation. After laryngoscope was applied, suddenly there was regurgitation of abundant dark brown colored material in the oral cavity. The saturation fell below 60%. Endotracheal intubation was done immediately following numerous times of endotracheal and oral suction, but SpO₂ fell continuously to uncheckable status combined with cardiogenic collapse. Chest compression was carried out with intravenous shooting of atropine 0.5 mg, epinephrine 0.6 mg. Arterial blood gas analysis (ABGA) was measured after asystole was terminated. The result of ABGA showed severe hypoxemia with hypercapnic respiratory acidosis. Anesthesiologists and surgeons agreed with applying venovenous (VV) extracorporeal membrane oxygenation (ECMO). After staring ECMO, saturation was maintained over 95%. The operation was canceled and the patient was moved to the intensive care unit (ICU). In the ICU, newly developed bilateral consolidations in both upper lung fields were seen on chest radiograph (Fig. 1). 6 days after the aspiration event, the patient was weaned from ECMO, and was tolerable with conventional ventilator support. 9 days after the event, extubation was done. One day of close monitoring after extubation, she moved to general ward.

Conclusions: If the severe hypoxemia and hypercapnea exists and no longer optimal gas exchange can be reached by conventional mechanical ventilation, early application of extracorporeal life support can have survival benefit.

Keywords: Acute lung injury, Aspiration pneumonia, Extracorporeal membrane oxygenation
RETROPHARYNGEAL HEMATOMA SECONDARY TO VOMITING IN A HEALTHY ADULT

Hyok-rae Cho
Kosin University Gospel Hospital, Republic of Korea

Introduction: Retropharyngeal hematoma occurs infrequently, whereas spontaneous case is also rarer among them. There are several factors involved in its etiology. By comparison, that disease needs emergency attention and critical airway care in the setting of airway obstruction, leading to more fatal outcome. The diagnosis can be difficult and a lot of clinician often overlooks this disease entity at their outpatient clinic. The early recognition of this pathology is very important with use of magnetic resonance imaging (MRI). Signal changes caused by blood products which are visible on the MR images suggest the diagnosis of retropharyngeal hematoma. With a review of the literature, the author presents a rare case of a 51-year-old woman with spontaneous retropharyngeal hematoma after vomiting.

Case: A 51-year-old woman was admitted to our hospital in Sep 2014 due to 3 days history of dull neck pain and orthopnea without history of preexisting neck disease. Especially, she felt dyspnea whenever she flexed her neck. Vomiting was suddenly developed due to indigestion just before she visited our hospital. Previous medical history was non-specific. On general examination, this patient looked healthy. The neck was non-tender and there was no significant limitation of neck movement. Her vital sign was also stable. A fiberoptic laryngoscopic examination revealed a slight anterior bulging of the posterior pharyngeal wall with preserved glottis space. Hemoatology evaluation showed a hemoglobin of 13.6 g/dL, white blood cell count (per mm3) of 6800 and platelet count of 278,000/dL, erythrocyte sedimentation rate (ESR) 15 mm/hr and C-reactive protein 1 mg/L. Biochemical analysis, Prothrombin time (PT), partial Thromboplastin time (PTT) and bleeding time were normal. Lateral soft tissue radiography of the neck showed increased thickness of prevertebral soft tissue: 11.6 mm at C1, 8.1 mm at C2, 9.8 mm at C3 and 9.8 mm at C4 (Figure 1). The airway was not significantly narrowed. And MR imaging was performed (Figure 2). The image sequences disclosed a retropharyngeal collection that exhibited high signal on routine T2-weighted image and fluid-attenuated inversion recovery (FLAIR) image. Low signal was also found at T1-weighted image. Above mentioned image sequences disclosed typical signal characteristics of an acute hematoma. The patient was managed conservatively with steroids and there was complete resolution of neck pain and orthopnea. On the third day her symptom almost all resolved. The patient was discharged within 7 days.

Conclusions: Our case illustrates a presentation of spontaneous retropharyngeal hematoma after vomiting in the form of no airway compromise. Physician should be aware that retropharyngeal hematoma may be early misdiagnosed and could lead to airway obstruction. An early lateral neck X-ray and MRI are essential for diagnosis and management of this rare disease. This knowledge is very important for managing retropharyngeal hematoma properly.

Keywords: Retropharyngeal hematoma, Airway, Intrathoracic pressure
ACUTE ENDOTRACHEAL TUBE OBSTRUCTION ON INHALATION BURN INJURY

Joon-hee Lee, Yong-duk Kim, Sangseok Lee, Byoung Hoon Yoo, Mun-chul Kim
Inje University Sanggye Paik Hospital, Republic of Korea

Introduction: There are several complications on inhalation burn injury, especially upper airway obstruction due to secondary edema, reactive bronchospasm from aerosolized irritants, small airway occlusion initially from edema and subsequently from sloughed endobronchial debris and loss of the ciliary clearance mechanism.

Case: Thirty six years old woman, no past history, admission on ICU due to inhalation burn injury. Five days after ICU admission, she showed sudden tachypnea and tachycardia. She was diagnosed as acute respiratory acidosis with CO2 retention (PaCO2 150 mmHg). We examined the endotracheal tube using fiberoptic bronchoscope, and found the foreign body in the endotracheal tube tip. The foreign body was sloughed endobronchial debris (Figure), which might reduce the lumen of the endotracheal tube. We performed tracheostomy to treat severe respiratory acidosis and remove the endobronchial debris immediately. However, a few debris was still remained in carina level and we confirmed it by fiberoptic bronchoscope. We performed rigid bronchoscopy for removing the debris in operating room under general anesthesia. Concerning about long apnea time during operation of bronchoscopy, we applied a total intravenous anesthesia (TIVA), and the extra-corporeal membrane oxygenation (ECMO). After removing all debris, the patient was weaned from ECMO and transferred to ICU with O2 supply with spontaneous respiration.

Conclusions: Acute airway obstruction is not uncommon in the inhalation burn patients. It is very important to prepare alternative ventilation method as like as tracheostomy or ECMO apply.

Keywords: Burn, Extracorporeal membrane oxygenation, Airway obstruction, Endotracheal tube obstruction
USE OF SHORT-ACTING BETA-BLOCKER IN THYROID STORM WITH LOW-OUTPUT CARDIAC FAILURE

Yi Hern Tan, Li Shan Jessica Quah
Ministry of Health Holdings, Singapore

Introduction: A 46 year old Chinese with low cardiac output thyrocardiac disease is successfully managed with intravenous esmolol.

Case: A 46 year old Chinese gentleman, with hypertension and previous cerebrovascular disease, presents with watery diarrhoea and bilateral lower limb swelling. Physical examination revealed an irregularly irregular heart rate of 170 beats per minute and ECG showed atrial fibrillation with rapid ventricular response. Bedside echocardiography demonstrated depressed left ventricular systolic EF of 20%. Laboratory investigations showed undetectable TSH levels, elevated free T4 (74.7 pmol/L) and T3 (12.1 pmol/L) with presence of anti-thyroid receptor antibodies. He was diagnosed with thyroid storm complicated by heart failure secondary to thyrocardiac disease. He received hydrocortisone, intravenous esmolol, carbimazole and Lugols iodine. Over the following 48 hours the patients free T3 levels decreased. Esmolol was withheld after achieving adequate rate control with bisoprolol and digoxin without haemodynamic instability. A maintenance dose of carbimazole and bisoprolol was prescribed. He was subsequently discharged with repeat assessment of both thyroid and cardiac function planned outpatient.

Conclusions: Thyroid storm is an uncommon but potentially fatal presentation of hyperthyroidism, with mortality of 30-60%. Thyroid hormone has many effects on the heart and vascular system independent of catecholamines. Cardiac manifestations include supraventricular arrhythmias, high-output and low-output congestive heart failure. Options for beta-blockade include propranolol and esmolol. Literature review of published case reports of sudden cardiorespiratory collapse in thyroid storm treated with propranolol suggest that in low cardiac-output thyrocardiac disease, short-acting beta blockers may be the safer alternative in patients who have heart failure with reduced ejection fraction.

Keywords: Thyrocardiac disease, Hyperthyroidism
COMMON CAROTID ARTERY DISSECTION DURING VENTRICULOPERITONEAL SHUNT PROCEDURE

Yong Han Kim, Hyun Joo Lee, Kyung-hwan Kim
Seoul National University Hospital, Republic of Korea

Introduction: Although ventriculoperitoneal (VP) shunt is considered to be a relatively safe and simple neurosurgical procedure, rare but dreaded complications can occur during the procedure. Herein we report an unusual and rare complication not reported before.

Case: A 45-year-old man previously had 6 repetitive VP shunt insertions or revisions for the last 10 years. He was readmitted for another shunt revision due to shunt failure. The neurosurgical doctors in charge at that time performed VP shunt revision under general anesthesia. However during the procedure, the neurosurgeons said that they encountered some difficulty during the tunneling process from the abdominal cavity to the Kochers point. When the tunneling trocar was removed, sudden swelling of the left neck was observed. Emergency computed tomography revealed acute dissection of the left common carotid artery (LCCA) with large perimuscular hematoma. The patient was immediately transported to the operating room again. We initially made an oblique incision on the neck and carefully performed division between the platysma and the sternocleidomastoid muscle. Unexpectedly, massive bleeding from the ruptured common carotid artery arised. Digital compression was instantly applied, however immobilization of the LCCA was not possible. We extended the oblique neck incision to the upper chest, performed upper partial sternotomy, and then exposed the origin of the LCCA from the aortic arch. Immobilization was done with vascular clamps, and the ruptured segment of the LCCA was replaced with a synthetic vascular graft successfully.

Conclusions: VP shunt may lead to a rare but serious complication that we should be aware of.

Keywords: Ventriculoperitoneal shunt, Common carotid artery
REMIND THE ABNORMALITIES OF CENTRAL VEIN DURING CATHETERIZATION FROM LEFT FEMORAL VEIN

Masanao Sunakawa, Tsuyoshi Maekawa, Makoto Ito, Takayuki Fukumoto, Sonoe Shinya, Chieko Sumi, Masayuki Nakamura, Kumiko Nakamura, Hisashi Tamura

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Introduction: It is easy to induce a central venous catheter (CVC) from femoral vein. But dislocation of the tip of the catheter may occur, especially it is induced from left femoral vein.

Case: [Case 1] A 51 y.o. man, CVC was induced from his left femoral vein. Blood could not be drawn back from the catheter. Because the tip of the catheter had dislocated to the left side of lumbar vertebra area, examined by abdominal X-ray. Existence of a left ascending lumbar vein was strongly suspected by re-construction of 3D-CT. [Case 2] A 60 y.o. man with hemorrhagic shock, received blood transfusion through CVC, induced from his left femoral vein. Ten days later, deep venous thrombosis was suspected. The double inferior vena cava and thrombosis in his left vena cava were demonstrated by contrast CT. Re-examining the pre-surgical abdominal X-ray, the tip of CVC was placed to left lumbar vertebral area.

Discussion: When the catheter is induced from left femoral vein, tip of CVC may dislocate to left ascending lumbar vein. The fact may cause retro-peritoneal hemorrhage. Abnormality of the inferior vena cava is seldom and double inferior vena cava exists in 1-3% of population. In these cases, deep venous thrombosis tended to grow by catheterization.

Conclusions: When CVC is induced from left femoral vein, we have to make sure the tip might be in right side of his vertebra to prevent complications.

Keywords: Left ascending lumbar vein, Double inferior vena cava
THE CASE OF PULMONARY EMBOLISM AND INFERIOR VENA CAVA THROMBOSIS DUE TO COMPRESSION BY HEMATOMA AFTER THE PANCREATICODUODENAL ARTERY ANEURYSM RUPTURED

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Introduction: Although pulmonary thromboembolism (PTE) is basically treated with anticoagulant and/or thrombolytic therapy, we should always consider bleeding risk and indwelling inferior vena cava filter (IVCF) for unstable deep vein thrombus (DVT) with high risk of thromboembolism.

Case: A 44-year-old man was treated pancreaticoduodenal artery (PDA) aneurysm rupture due to median arcuate ligament syndrome by coil embolization. At 20 days later, PTE (submassive type) occurred and was taken to our hospital emergency. The retroperitoneal hematoma compressed IVC, and a large amount of DVT formed in the infrarenal IVC, very close to renal vein. He was indwelled IVCF at suprarenal position. On the 4th day, he complained of a back pain and faintness suddenly. Since the infrafilter IVC was completely occluded by thrombus, we performed transcatheter fragmentation, transcatheter aspiration of thrombus, and intravenous thrombolytic therapy (urokinase 24000 units per day, total 7 days). Anticoagulant therapy with warfarin was followed as postoperative medication. Thrombus of pulmonary artery and IVC regressed. On the 32nd day, IVC filter was removed and the patient discharged.

Conclusions: There were few reviews about PTE and DVT as a sequel of PDA aneurysm rupture. We reported the rare case with PTE and DVT requiring the combined therapy with anticoagulant, thrombolysis, transcatheter therapy and suprarenal IVCF.

Keywords: Deep vein thrombus, Inferior vena cava filter, Suprarenal, Pancreaticoduodenal artery, Pulmonary thromboembolism
PECTORAL MUSCLE STIMULATION IN PATIENT WITH A CARDIAC PACEMAKER

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**Introduction:** Pacemaker-induced extracardiac stimulation involves the diaphragm, the pectoral or the intercostal muscles. It may lead to anxiety, discomfort and LV pacing lead problems, that it should be treated promptly.

**Case:** A 64-year-old man with pacemaker was admitted for RRP under general anesthesia. The pacemaker mode was changed from DDDR to DOO. During operation, the patient was stable with a heart rate of 65 beats/min. In the post anesthesia care unit, the patient complained of pain on left chest with rhythmic contraction of the left pectoral muscle. Heart rate change from 70-80 beats/min was also observed. 12 lead ECG and chest radiographs (Fig. 1, 2) were taken. The reduced atrium pacing impedance below 250 Ω was found in the bipolar configuration. So we suspected lead insulation defect and changed pacemaker mode from DOO to DDDR and set heart rate to 60 beats/min. Afterwards, the symptom was subsided.

**Conclusions:** Pectoral muscle stimulation may happen from a leakage of current originated from a lead insulation failure, exposed connector or rotation of the connector. When perioperative extracardiac stimulation occurs, immediate chest radiographs and pacemaker analysis are needed. If the lead impedance is reduced, we should suspect lead insulation defect. In most cases, reprogramming of the pacemaker solves the problem. If not, lead repositioning or replacement may be required.

Keywords: Pacemaker, Extracardiac stimulation, Complication
THE MANAGEMENT OF PATIENT WITH SEVERE AORTIC STENOSIS AND MODERATE MITRAL REGURGITATION, WHO DEVELOPED SUPER ACUTE HEART FAILURE IMMEDIATELY AFTER TRANSCATHETER AORTIC VALVE IMPLANTATION

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Introduction: Transcatheter aortic valve implantation (TAVI) is an alternative treatment for patients with severe aortic stenosis (sAS), but indication for patients with pre-existing mitral regurgitation (MR) remains controversial. Also in hospital mortality after TAVI is reported to be 5.5%, but the incidence of acute heart failure is unclear. We present a case of super acute cardiac failure (AHF) that developed immediately after TAVI, in patients with sAS and MR.

Case: An 87-year-old male with sAS, and moderate MR was scheduled for TAVI. Trans-femoral TAVI was performed under general anesthesia. Hypertension and tachycardia were seen immediately after extubation, and 15 minutes later the patient became hypoxic and showed symptoms of AHF. Chest X-ray showed pulmonary edema, and he was admitted to the ICU after reintubation. Evaluation by echocardiography showed no signs of valve failure, ischemia, nor volume overload, but complete left bundle branch block (CLBBB) was observed on ECG. He was managed under mechanical ventilation and his blood pressure was controlled to reduce afterload. He was extubated at 1POD and received noninvasive positive pressure ventilation (NPPV) until 2POD. After 1 month follow up, slight exacerbation of MR was seen, and he was treated with diuretic for pleural effusion.

Conclusions: The exact reason for AHF is unclear, but the development of CLBBB which caused the dyssynchrony of the left ventricle contraction, and the increase of afterload and heart rate during the emergence from anesthesia, could have triggered AHF. Intensive monitoring and careful observation are mandatory to recognize the symptoms of AHF after TAVI procedure in patients with MR.

Keywords: Transcatheter aortic valve implantation, Acute heart failure, Noninvasive positive pressure ventilation
NON-SELECTIVE BETA-BLOCKER INDUCED HYPERKALEMIA IN OFF-PUMP CORONARY ARTERY BYPASS PATIENT

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Introduction: Non-selective beta-blocker administration can induce hyperkalemia caused by inhibition of cathcholamin-induced renin release and Na-K-ATP pump. We report a case that non-selective beta-blocker related hyperkalemia induced low cardiac output syndrome after emergent off-pump coronary artery bypass.

Case: A 49 year-old male with DM came to emergency department due to cardiac arrest. Under STEMI impression, coronary angiography was performed. The result was three-vessel CAOD so emergent OPCAB was performed. Surgery was conducted without any event and achieved complete revascularization. After operation, vital signs were stable except tachycardia (120 bpm) so propranolol 10mg was administrated. 2-hour after administration, hypotension and decrease of cardiac index (2.9 → 2.2) suddenly developed. We increased infusion rate of inotropics and vasopressor but did not recovered. Hyperkalemia (7.1 mMol/L) was checked, we thought low cardiac output state due to hyperkalemia so tried to lead intracellular shifting by lasix administration and insulin mixed dextrose fluid infusion. Cardiac index has recovered gradually for 2 hours, we could taper infusion rate of inotropics and vasopressor. The follow up serum potassium level was 4.3 mMol/L, no more hyperkalemic event after propranolol cessation. There was no other cause then induced hyperkalemia, so we judged that the hyperkalemic event caused by propranolol administration. Since the patient was discharged without any adverse event and follow up at out-patient clinic.

Conclusions: Beta-blocker can cause hyperkalemia by the less common side effects. Especially it can be fatal in patients after surgery because hyperkalemia can induce low cardiac output status. As administration of non-selective beta-blocker, we should think about the occurrence of hyperkalemia.

Keywords: Hyperkalemia, Low cardiac output, Propranolol
EXTRACORPOREAL MEMBRANE OXYGENATION IN A POSTPARTUM PATIENT WITH EISENMENGER SYNDROME: A CASE REPORT

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Introduction: Although extracorporeal membrane oxygenation (ECMO) has not been extensively studied in pregnancy, several papers report the safe use of ECMO in extreme circumstances in pregnant women with perioperative cardiopulmonary complications or disease. Especially, the Eisenmenger syndrome usually worsens during pregnancy and increase the risk of a poor maternal outcome. Here, we describe the use of ECMO in a 34-year-old woman at 26-2 weeks gestation, following cardiac arrest immediately post-partum.

Case: She underwent spinal anesthesia for the emergent caesarean section due to vaginal bleeding due to placenta previa and intrauterine fetal death. She had an Eisenmenger syndrome with congenital atrial septal defect, of which medication was stopped after pregnancy by herself. During operation, her vital signs were maintained within normal ranges except of peripheral arterial saturation (SpO₂, up to 68%). After end of caesarean section, hypotension (< 100 mmHg of systolic blood pressure), bradycardia (< 35 beats/min), and hypoxemia (< 50% of SpO₂) was sustained, followed with resuscitating from repeated cardiac arrest. We decided to apply ECMO for cardiovascular and pulmonary stabilization, by which SpO₂ was maintained between 70 to 90%. Unfortunately, she died in the intensive care unit without physical and neurologic recovery post-operative day 23.

Conclusions: Although she was expired despite of our utmost efforts, we suggest that ECMO should be considered in such extreme life-threatening cases, and the management of Eisenmenger syndrome needs a multidisciplinary approach involving cardiologist, cardiac surgeon, obstetrician, and anesthesiologist to achieve a safe pregnancy and cesarean for the delivery of the baby.

Keywords: Arrest, Atrial septal defect, Eisenmenger syndrome, Extracorporeal membrane oxygenation, Post-partum
OCTREOTIDE IN THE TREATMENT OF CHYLE LEAKAGE AFTER HYBRID ZONE 1 THORACIC ENDOVASCULAR AORTIC REPAIR: A CASE REPORT

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Introduction: Thoracic endovascular aortic repair (TEVAR) is becoming increasingly popular due to reduced perioperative morbidity and mortality compared with open surgical repair. However, if aortic arch is involved, TEVAR is technically demanding, requiring hybrid approach of aortic arch debranching with re-routing of supra aortic trunk and exclusion of pathological portion of aortic arch employing endograft. Especially, re-routing procedure, which is carried out in the lower regions of the neck, especially the left, can results in the complications like chylothorax or chyle leakage. We herein present the case that chyle leakage was noted after TEVAR with carotid-subclavian artery bypass.

Case: A 66-year-old male was transferred due to dyspnea, cough, and the sudden onset of back pain 2 weeks ago. Aortic computed tomography (CT) showed a thoracic aortic aneurysm. TEVAR with right common carotid-left common carotid-left subclavian artery bypass was performed under total intravenous anesthesia with propofol and remifentanil. Chylothorax was noted after surgery with drainage of about 1000 mL per day after operation 4 days. Chyle leakage was controlled with Octreotide intravenous injection for 17 days. It was effective and he was discharged without any complications at postoperative 4 weeks.

Conclusions: Chyle leakage can occur after TEVAR with right common carotid-left common carotid-left subclavian artery bypass and Octreotide the effective alternative modality before deciding surgical approach to the thoracic duct for treatment of chyle leakage.

Keywords: Thoracic endovascular aortic repair, Carotid-subclavian artery bypass, Octreotide, Chyle leakage
EMBOLIC ISCHEMIC STROKE ASSOCIATED WITH TYPE III AORTIC DISSECTION

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Introduction: Aortic dissection is uncommon and potentially life-threatening disease. Classification of aortic dissection is based on involvement of the aortic dissection. According to Debakey classification, type I is involved from the ascending aorta to aortic arch, type II involved ascending aorta and type III originate in descending aorta. Rate of development of ischemic stroke in patients with aortic dissection is up to 30% in previous report. We present a case of multiple embolic ischemic stroke patients with type III aortic dissection.

Case: A 42-year-old male suffered from epigastirc pain and CT scan revealed aortic dissection involved from descending aorta to common iliac artery. He admitted to department of chest surgery and referred to intensive care unit. Initial consciousness was normal. One day after admission, he presented hypsomnolence and disorientation. Diffusion MRI showed multiple small diffusion restricted lesion on bilateral frontal and temporal lobe. There was no stenosis or occlusion on Head and Neck CT angiography. Patient was transferred to department of neurology. Extensive etiology work up was carried out to find the source of embolic stroke. Either thrombus or right to left shunt was not observed in transthoracic echocardiography. He received antiplatelet agent and strictly controlled blood pressure. One month later, neurological status was completely recovered.

Conclusions: As the blood flow moves towards descending aorta, exact mechanism of embolic ischemic stroke associated with aortic dissection which involved only descending aorta is not well understood. Diastolic retrograde flow was possible explanation for our uncommon case of embolic stroke originated from descending aorta.

Keywords: Aortic dissection, Embolic ischemic stroke
RECURRENT PULSELESS VENTRICULAR TACHYCARDIA INDUCED BY COMMOTIO CORDIS TREATED WITH THERAPEUTIC HYPOTHERMIA

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Introduction: Commotio cordis occurs most commonly in young males. The survival rate of this syndrome is low and there is often neurological disability if the return of spontaneous circulation (ROSC) is achieved. The 2010 American Heart Association Guidelines recommend the use of therapeutic hypothermia (TH) in adult cardiac arrest patients when the initial rhythm is ventricular fibrillation (VF). TH is considered to improve survival with favorable neurological outcome in the case of global cerebral ischemia after cardiac arrest.

Case: A 16-years-old female was transferred to our emergency department (ED) for post-resuscitation care from other hospital. She has no structural heart problem or arrhythmia on past medical history. She was struck with a valley-ball on her anterior chest wall, and collapsed at the scene. She was brought to local medical center, pulseless ventricular tachycardia (VT) was reported on monitor and ROSC was achieved with Defibrillation. She was comatose on arrival to our ED and vital sign was stable. She treated TH at target temperature of 32-34°C for 24hours. After transferred to the intensive care unit, pulseless ventricular tachycardia occurred and 2 times defibrillation was done and then immediately resumed cardiopulmonary resuscitation (CPR). After 4 minutes of CPR, ROSC was achieved. She was recovered to baseline neurologic status with the exception of some short-term memory difficulties (CPC 1).

Conclusions: We report a case of commotio cordis treated with TH and had a good neurologic outcome. TH could be helpful for a broader patient than current recommendation.

Keywords: Therapeutic hypothermia, Commotio cordis, Cardiac arrhythmia
ADRENAL INCIDENTALOMA: A CASE OF ASYMPTOMATIC PHEOCHROMOCYTOMA

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Introduction: Adrenal incidentaloma remains as a diagnostic defiance. The most principal distinction to make is between the possibilities of malignant or functional masses. Even after thorough examinations, many cases of the adrenal incidentaloma lack a definitive diagnosis.

Case: A 42-yr-old male patient was brought to the emergency center with acute respiratory failure and hemodynamic instability. Echocardiography revealed severe stress induced cardiomyopathy. The patient was transferred to the intensive care unit (ICU) to be cared for the severe metabolic acidosis, lactic acidosis, and patient's kidney function, and the continuous renal replacement therapy was administrated. The patient had undergone elective arthroscopic biceps tendon repair surgery 4 hours ago. His upper abdomen pre-op ultrasound showed 4.86 cm round solid mass in the left abdomen, medial to the left kidney. At the beginning of the induction, the patient hemodynamic changes were progressively worsened. Hemodynamic instability persisted after induction, and his BP remained very labile throughout the entire procedure of around 1 hour 30 minutes. Despite the adequate anti-hypertensive therapy and depth of anesthesia, the BP and HR remained difficult to control. Day 2, the patient’s condition further deteriorated, despite the efforts to maintain tissue oxygenation and adequate volume. On day 3, complete asystolic cardiac arrest ensued and CPR was performed. However, the patient expired, despite of the administrated epinephrine and CPR. Autopsy confirmed pheochromocytoma.

Conclusions: More thorough evaluation should be performed on adrenal incidentaloma through biochemical and imaging tests to prevent peri- and post-operative hypertensive crisis and tachycardia associated with undiagnosed pheochromocytoma.

Keywords: Adrenal incidentaloma, Hypertensive crisis, Pheochromocytoma
HYPERFIBRINOLYSIS AT THE PATIENT WITH NEWLY FOUND OESOPHAGUS CANCER

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Introduction: Prothrombotic activity and hypofibrinolysis in cancer patients is published very often. To the contrary, hyperfibrinolysis in these cases is rarely documented in the literature.

Case: We present a case report of 43 years old patient, who was found at home with cardiac arrest. There was asystole, haematemesis and blood aspiration. After resuscitation- ROSC time 15 min.-he was transported to our hospital. In the medical history only alcoholism and some traumatic episodes in drunkenness were known. At the emergency department the patient was in haemorrhagic shock with anaemia, severe combined acidosis and continuouls bleeding. Thromelastometry (ROTEM) showed prolonged clotting time in EXTEM and INTEM, wide amplitude (A10) in EXTEM, INTEM and FIBTEM. After 18 minutes we could see the typical image of hyperfibrinolysis. We treated the patient with tranexamic acid and PRBC. Urgent gastroscopy revealed a huge exulcered oesophagus tumor, obturating the oesophagus and forbidding the passage of the gastroscope into the stomach.

Conclusions: Even though the prothrombotic status is presumed in cancer patients, we also have to think about hyperfibrinolysis. ROTEM is the best method in the early detection of hyperfibrinolys.

Keywords: Hyperfibrinolysis, ROTEM, Thrombelastography, Cancer
ABDOMINAL COMPARTMENT SYNDROME DURING NEOADJUVANT CHEMORADIOThERAPY FOR RECTAL CANCER

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Introduction: Although acute toxicities from neoadjuvant chemoradiotherapy (nCRT) for intraabdominal cancer would be mostly gastrointestinal or hematological, there have been no articles reporting abdominal compartment syndrome (ACS) during nCRT.

Case: In this report, we describe the life threatening ACS which unexpectedly encountered during nCRT for locally advanced resectable rectal cancer in a 79-year-old man with no medical history. Rectal cancer located in 6 cm above anal verge and was the non-obstructing and ulcerofungating lesion. He underwent preoperative treatment with oral capecitabine (1650 mg/m2/day) in combination with radiation therapy. He complained of mild abdominal pain after 21th radiotherapy (3780 cGy) with concurrent chemotherapy. Abdominal X-ray showed paralytic ileus with no bowel distension. However, abdominal distension was abruptly aggravated two days later, and loss of consciousness and septic shock developed. Despite maximal vasopressor and ventilator support, his hemodynamic and ventilator parameters rapidly deteriorated and he was finally expired without abdominal decompression 3 days after shock developed.

Conclusions: Oncologist or surgeon should recognize that ACS could be the acute toxicity of nCRT.

Keywords: Neoadjuvant therapy, Rectal cancer, Acute toxicity
ENDOVAC TREATMENT FOR ESOPHAGEAL RUPTURE

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**Introduction:** Rupture is a dangerous complication of esophageal foreign body. Moreover delayed diagnosis disrupts the success of primary esophageal closure. We introduced the successful case of endoVAC treatment for esophageal rupture after primary closure.

**Case:** Male with 50 years old visited emergency room due to chest pain and dysphagia. He ingested large pork spine before 3 days. Urgent surgery was performed due to the large size of the spine. The pork spine ruptured esophagus. It was removed and esophagus was closed successfully. Chest tube and JP drainage was inserted and the contents were clear. However On post operative 3 day, it changed into dirty and follow up esophago-gastro-duodenoscopy (EGD) showed remnant esophageal rupture. To avoid esophagectomy or esophagostomy, EndoVAC was applied by EGD. Ruptured hole was diminished and closed with 3 consecutive endoVAC trials.

**Conclusions:** EndoVAC can be alternative treatment for esophageal rupture. Esophagostomy or esophagectomy are treatment of choice for esophageal perforation, but they are invasive and not good for quality of life. However endoVAC is less invasive and easy to apply.

Keywords: Esophageal rupture, EndoVAC
FOUR CASES OF SEVERE FEVER WITH THROMBOCYTOPENIA SYNDROME

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Introduction: Severe fever with thrombocytopenia syndrome (SFTS) is a life-threatening viral infection transmitted by ticks. Since the first report in 2010, SFTS has been reported in China, Korea, and Japan. Here we report four cases of SFTS which need intensive care.

Case: The subjects were 83-year-old female, 57-year-old female, 88-year-old male, and 77-year-old male. All of them were seen in clinics because of fever. The tick bite was confirmed in two cases, and was suspected in other two cases by history of present illness. Blood tests showed leukopenia, thrombocytopenia, and liver dysfunction. SFTS virus was detected in sera of all four cases. Hemophagocytosis was observed in bone marrow, and steroid was used for the treatment of hemophagocytic syndrome in all cases. All of them were complicated with bacterial and fungal infection, and were treated with antibiotics and antifungal medications. However, they were difficult to cure. Three cases died, and one case recovered and left the hospital. The survivor was younger than non-survivors.

Conclusions: Patients with SFTS seem to have normal neutrophil function, but were complicated with bacterial and fungal infection. It may be important to consider these patients as compromised hosts, to search for infection, to use appropriate antibiotics, and to overcome the difficult phase of organ failure.

Keywords: SFTS, Sepsis, Tick
PRIMARY INVASIVE Gastrointestinal Aspergillosis IN A PATIENT WITHOUT IMMUNE DISORDER: CASE REPORT

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Introduction: Invasive aspergillosis is most commonly seen in patients with immune disorders and usually in the lung. Gastrointestinal invasive aspergillosis is usually seen as a part of a disseminated infection and rarely as an isolated organ infection. This report presents a case of isolated invasive Aspergillus enterocolitis developing without disseminated aspergillosis in a patient with no predisposing factors, such as immunosuppression.

Case: A 53 year old male referred to our emergency department in shock state after drinking large amount of alcohol without any food. Initial blood pressure was 82/50 mmHg, pulse rate was 78 bpm, respiratory rate was 28/min, and body temperature was 34°C. Arterial blood gas analysis (ABGA) represents severe metabolic and lactic acidosis. Abdominopelvic CT showed acute pancreatitis with peripancreatic infiltration and severe enterocolitis. He referred to medical intensive care unit to manage about septic shock. During hospitalization, hematochezia was developed and 3 days later the patient presented with abdominal distension and increased intraabdominal pressure, and developed septic shock. Laparotomy was performed due to bowel ischemia and perforation. He underwent near total small bowel resection, total proctocolectomy, and end jejunostomy. We found multifocal ischemic and necrotic change through the whole bowel except about 100 cm segment of proximal small bowel. Terminal ileum was conglomerated and showed a severe necrotic change. Pathology was invasive aspergillosis with angioinvasion.

Conclusions: Invasive aspergillosis is rarely considered in patients without immune disorder. Therefore it makes delayed diagnosis and poor clinical outcome. In immunocompetent patients with severe disrupted gastrointestinal mucosal barrier, should be considered about the aspergillus infection.

Keywords: Invasive aspergillosis, Gastrointestinal, Immunocompetent
A MORBID OBESITY PATIENT NEEDS SPECIAL CONSIDERATION FOR THE TRACHEOSTOMY TUBE CHOICE. USEFULNESS OF EARLY TRACHEOSTOMY AND ADJUSTABLE TRACHEAL TUBE

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**Introduction:** Morbidly obese patients have a risk of developing airway obstruction after tracheostomy. The fixed tracheal tube length may be inappropriate for obese patients. The optimal tracheal tube device and tracheostomy timing following percutaneous cardiopulmonary support (PCPS) discontinuation is unknown. We report the usefulness and safety of early tracheostomy and adjustable tracheal tube, Adjust fit, for a morbidly obese patient.

**Case:** A morbidly obese 42-year-old male collapsed after developing chest pain. A rescue squad found him in a state of cardiac arrest, administered chest compressions, and brought him to the hospital. Coronary angiography revealed occluded left anterior descending artery; he underwent percutaneous coronary intervention after intubation and PCPS. Heavy sedation triggered spontaneous breathing cessation; hence, maintaining sufficient airway pressure through mechanical ventilation was challenging because of decreased chest wall compliance. Tracheostomy and Adjust fit were performed before discontinuing PCPS on the fourth day of admission. Mechanical ventilation via tracheal tube achieved light sedation and no severe desaturation, with spontaneous breathing throughout PCPS weaning and discontinuation. Optimal timing of tracheostomy after PCPS discontinuation remains unknown. Airway occlusion is lethal in morbidly obese patients who are at risk for developing complications related to mask ventilation, intubation, and tracheostomy. Tracheostomy prior to PCPS discontinuation may ensure light sedation and spontaneous breathing. Additionally, Adjust fit is useful for obese patients; it allows deep insertion of tracheal tube tip, enabling appropriate placement of the tube within the trachea.

**Conclusions:** Early tracheostomy with “Adjust fit” enables successful airway management in a morbidly obese patient.

Keywords: Adjustable tracheal tube, Morbid obesity patient
Figure 1. Tip of the adjustable tracheal tube inserted into the trachea in a morbidly obese patient

Figure 2. Adjustable tracheal tube, “Adjust Fit™”
USEFULNESS OF SONOGRAPHIC EVALUATION OF THE DIAPHRAGM IN MECHANICALLY VENTILATED PATIENTS WITH DIAPHRAGMATIC PARALYSIS: A REPORT OF TWO CASES

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Introduction: Although sonographic evaluation of the diaphragm has been studied in recent years, its clinical significance has been poorly clarified. We describe two cases in which sonographic assessment of the diaphragmatic motion provided critical information on respiratory management such as diagnosis, the timing of tracheotomy, and weaning process in mechanically ventilated patients with neuromuscular disease.

Case: A 42-year-old woman and a 44-year-old man presented with respiratory failure requiring mechanical ventilation, and admitted to our intensive care unit. Clinical diagnoses were brainstem encephalitis and Guillain-Barre syndrome, respectively. To figure out the cause of respiratory failure, we measured diaphragmatic excursion during a deep breathing by M-mode ultrasonography bilaterally via the liver and the spleen, respectively, as an acoustic window. Severe bilateral diaphragmatic paralysis, excursion less than 1 cm, was diagnosed and remained for days, which made us decide to perform early tracheotomy. We tracked the recovery of diaphragmatic excursion and right after it regained a normal level, 3.7 cm for women and 4.7 cm for men, patients were successfully weaned from mechanical ventilation. On the other hand, conventional weaning parameters such as rapid shallow breathing index or vital capacity did not seem to predict successful weaning in these patients.

Conclusions: In patients with diaphragmatic paralysis, measurement of the diaphragmatic excursion during a deep breathing by M-mode ultrasonography is a simple and noninvasive method to diagnose this clinical entity, and the repetitive measurement may be useful for determining the timing of tracheotomy and ventilator weaning.

Keywords: Ultrasonography, Diaphragmatic excursion, Diaphragm
Fig. 3 Clinical course of the patient 2
mPSL, methyl-prednisolone; IVIG, intravenous immunoglobulin
A CASE OF DELAYED POST-HYPOXIC LEUKOENCEPHALOPATHY DUE TO SEVERE ARDS

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Introduction: Delayed post-hypoxic leukoencephalopathy (DPHL) is a rare complication of hypoxic encephalopathy, which is mainly related to carbon monoxide poisoning and narcotics overdose. We present a case of leukoencephalopathy that may have been due to hypoxia caused by severe ARDS in a man with acute myeloid leukemia.

Case: A 22-year-old man was transferred to our hospital exhibiting unconsciousness, hypotension, fever, and an increased number of WBCs. On admission, the Glasgow coma scale of the patient was 8. His breathing rate was 36, and SpO2 was 60~70% with 10L of oxygen administration. He was developing severe ARDS and severe sepsis due to pneumonia. Bone marrow examination revealed that he had developed acute myeloid leukemia. Chemotherapy was initiated along with intensive therapy for severe ARDS and sepsis. On day 15, his trachea was successfully extubated. On day 17, his mental status was observed to have deteriorated. The brain CT showed low density in the white matter of the bilateral cerebral hemispheres, and MRI showed hypointensity in the deep white matter of the bilateral cerebral hemispheres, demonstrating leukoencephalopathy.

Conclusions: Toxic encephalopathy including DPHL is caused by multiple etiologies. To the best of our knowledge, this is the first report of DPHL caused by ARDS. We will describe and report this case along with a review of related reports.

Keywords: Leukoencephalopathy, Leukemia, ARDS
CASE STUDY: MASSIVE BRAIN TRAUMA-FROM RESUSCITATION THROUGH BACK TO SCHOOL!!!

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Introduction: Primary purpose is presenting a case of massive traumatic brain injury (TBI) in an 18-year-old patient highlighting timely, aggressive diagnostics, mechanism-based and multidisciplinary clinical management throughout the continuum of care. Secondary purpose is highlighting a caring environment as integral to family support through ED, OR/ICU, acute and rehabilitation phases of care. Clinical/neurodiagnostic findings are correlated with injury location and severity as are rapid interventions for modulating brain, cerebrospinal fluid (CSF), blood volumes, stress and metabolic state including craniectomy and targeted temperature management.

Case: The patient in this case study was effectively managed with particular attention paid to cardiopulmonary physiology, ventilator management, positioning, metabolic suppression, osmotic diuresis, CSF drainage, progressive hemicraniectomy and their effect on intracranial pathophysiology following TBI. Brain arousal modulation in this patient was accomplished initially by deep sedation/analgesia and followed by barbiturate-induced coma and targeted temperature management. Therapeutic indications and risks are appraised. For refractory intracranial hypertension, decompressive hemicraniectomy was effective as third-line therapy and was effective in preventing terminal brain herniation. EEG-derived monitoring is analyzed relevant to therapeutic endpoints, real-time drug titration and extension of injury.

Conclusions: This case and favorable neurologic and clinical outcomes illustrates evidence-based practice, multidisciplinary collaboration, optimal family care and patient trajectory through the continuum of ED resuscitation, operative, ICU and rehabilitation phases of care. The effectiveness of close neurologic surveillance in recognizing progressive injury and consequent opportunity for effective treatment cannot be overstated. Content application facilitates efficient, protocol-driven interventions for altered cerebral hemodynamics and improves outcomes.

Keywords: Hypothermia, Hemicraniectomy, Barbiturate coma
CENTRAL PONTINE MYELINOLYSIS WITH UNCONTROLLED DM, WITHOUT HISTORY OF CORRECTION OF HYPONATREMIA

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National Medical Center, Republic of Korea

Introduction: We will report a rare case of CPM due to uncontrolled DM.

Case: The 59-year old woman was admitted to our emergency department (ED) with generalized tonic-clonic seizure (GTC). At admission, her mentality was confusion. After initial examination, she had a seizure again without recovery of consciousness. She had been hospitalized to control DM 2 months ago. Neurologic exams revealed positive barbinski sign on both feet, but other tests were impossible due to drowsy mentality. Diabetic ketoacidosis was diagnosed on a laboratory test. She underwent DWI (diffusion-weighted image) to rule out metabolic encephalopathy. High signal intensity in pons on DWI and T2 flair image was seen (Figure C, D). After 10 days on admission, MRA (magnetic resonance angiography) was taken. The MRA showed more massive high signal intensity in pons on T2 flair images (Figure E). We reviewed her past medical record to evaluate the cause of cental pontine myelinolysis (CPM). We found that she had visited ED with dysarthria and right side weakness 10 weeks ago. No neurologic deficit except dysarthria was found on initial neurologic exam. Laboratory findings showed that mild hyponatremia (127 mEq/L) and high blood glucose level (676 mg/dL). But she had never been treated for hyponatremia. After hydration and control of glucose level, her neurologic symptoms were improved completely. A review of previous DWI showed that a high signal intensity in pons on DWI, without flair change (Figure A, B).

Conclusions: Any neurologic symptom of uncontrolled DM patient should be evaluated for CPM even there is enurologic recovery.

Keywords: Central pontine myelinolysis, Uncontrolled DM
MASSIVE GASTROINTESTINAL HEMORRHAGE IN PATIENT WITH NEOPLASTIC CEREBRAL ANEURYSMS FROM METASTATIC CHORIOCARCINOMA - A CASE REPORT

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Introduction: Intracranial neoplastic aneurysm from choriocarcinoma is a very rare, and to consider the cause of complicating massive gastrointestinal hemorrhage to be metastatic carcinoma is somewhat unfamiliar in critical neurosurgical practice. The authors present the case of evolving neoplastic aneurysms of metastatic choriocarcinoma with massive gastrointestinal hemorrhage.

Case: A 28-year-old woman with the intrauterine fetal death 2 months prior to presentation was admitted to the neurosurgical service due to right-sided hemiparesis. The initial brain CT scan showed intracerebral hemorrhage in right temporal and left fronto-parietal region and brain MRI showed no additional information. With follow up brain CT revealed subarachnoid hemorrhage, denser in left side sylvian fissure. On conventional cerebral angiography, there were two aneurysmal dilations at distal cortical branch of left side middle cerebral artery with delayed staining which showed evolving course. We performed two hematoma evacuation for the huge recurrent intracranial hematoma. During the course, there were hemoglobin decrease and high titer of serum β-HCG and systemic cancer survey revealed multiple metastasis to lung, liver, intestine and left side femur and brain. With massive gastrointestinal hemorrhage due to jejunum ulcer, which required segmental resection of jejunum and ileum allowed us to get her pathologic specimen. Choriocarcinoma was diagnosed after histological examination. With surgical procedures, further treatment was done using combination chemotherapy and radiotherapy especially for brain. The patient still alive about 4 and half year without recurrence.

Conclusions: In female patient of childbearing age, choriocarcinoma must be considered in the differential diagnosis, especially multiple spontaneous intracranial hemorrhage with massive gastrointestinal hemorrhage.

Keywords: Neoplastic aneurysm, Gastrointestinal hemorrhage
REEMERGENCE OF STROKE DEFICITS WITH BENZODIAZEPINE: A CASE REPORT

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Introduction: After receiving sedatives, especially benzodiazepine, patients who have sustained a neurological injury due to stroke and then improved may experience transient reemergence of their syndromes. The exact mechanism is uncertain and those cases are rarely reported. Here, we present an unusual case of reemergence of stroke deficit after benzodiazepine use.

Case: A 73-year-old woman who have experienced a transient left side hemiparesis 5 years ago, was brought to the emergency room due to an altered mentality. She took a lot of sedatives for suicidal attempt. Initially she was stuporous. A CT scan showed no abnormality. An EEG revealed continuous beta activities. A urine toxicology screening test showed positive result on the benzodiazepine. She became alert after flumazenil injection but came back into stupor soon. Under the diagnosis of benzodiazepine intoxication, conservative management was started. At the second day after admission, she was drowsy and had left hemiparesis. An MR imaging was done and it showed no acute lesion. However, there was a cystic parenchymal defect on right periventricular white matter seemed to be chronic infarction. On the sixth day after admission, she became alert and did not show any motor weakness.

Conclusions: There are some reports and investigations about exacerbation or unmasking of neurologic deficit by sedatives. If a patient who had a previous stroke history shows similar symptom and decreased mentality, we must consider whether the patient takes sedatives, at first.

Keywords: Reemergence, Sedative, Benzodiazepine, Stroke
LIFE THREATENING Rhabdomyolysis IN STURGE-WEBER SYNDROME

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Introduction: Rhabdomyolysis is not common in Sturge-Weber syndrome (SWS), which is a rare disorder with neurologic and cutaneous signs of vascular origin. We experienced the case of a patient with SWS developing rhabdomyolysis due to vascular narrowing. Systemic vasculopathy of arteries as well as veins have not been reported in SWS.

Case: A 15 year-old girl, previously diagnosed with SWS, was admitted with hypertension, and presented with intermittent claudication in the lower limbs on exercise. Extensive port-wine stains had been present at birth. She had history of congenital glaucoma and the finding of leptomeningeal enhancement on brain MRI, which was taken for endovascular embolization of intracranial aneurysm, at age 14. Upon admission, antihypertensive management was started using intravenous nicardipine. CT angiographies showed focal severe stenosis at right proximal renal artery and diffuse narrowing both of the lower extremity arteries and veins. On the second day, she complained of leg pain, and abruptly developed cardiac arrest requiring cardiopulmonary resuscitation during twenty minutes. Severe hyperkalemia was revealed, owing to rhabdomyolysis which was supported by ischemic features of lower limbs and laboratory tests as follows: hyperCKmia, elevated serum myoglobin, and renal failure. Mechanical ventilator care and continuous renal replacement therapy were initiated. She was treated with a systemic vasodilator drug (PGE1) and anti-inflammatory medications like intravenously immunoglobulin and steroid. Over two weeks, her ischemic changes on legs were gradually recovered, and the follow-up CT showed improvement of diffuse narrowing on lower limbs.

Conclusions: We report the first case that Sturge-Weber syndrome coexists with vasculopathy that resulted in life-threatening rhabdomyolysis.

Keywords: Sturge-Weber syndrome, Rhabdomyolysis, Vasculopathy
LIMBIC ENCEPHALITIS: DIAGNOSTIC AND THERAPEUTIC CHALLENGES IN ICU

Lylian Andrea Brunetto Saez, Mario Canitrot Panyagua, Horazio Panzardo, Jorge Silva, Nicolas Andres Urrutia Gonzalez, Rut Leiva Jara, Sebastian Ugarte Ubiergo

NeuroICU. Critical Care Centre, INDISA Clinic, Andres Bello University, Chile

Introduction: Limbic encephalitis is an infrequent, paraneoplastic entity by multiple clinical manifestations and diagnosis and treatment which involves severe difficulties for the intensivist.

Case: A 72 years man, DM2, hypertension, chronic ischemic stroke, smoking. It comes with 20 day history of progressive hearing loss and left lateropulsion, dysarthria, gait difficulty, temporal spatial disorientation, double vision and memory failure. commitment of both time and bilateral midbrain stems with increased signal in both hippocampus and midbrain in Flair and diffusion. Pancytopenia, elevated VHS. Lumbar puncture proteins 0.78 g/dl normal cellularity, negative viral panel. For suspected infectious encephalitis ceftriaxone, ampicillin, acyclovir and metilpredisolona only for three pulses (suspended for sepsis ). At day 3 he developed respiratory distress and impairment of consciousness to GCS 8 is connected to VMI by nosocomial pneumonia basal For persistent pancytopenia in context of encephalitis of unknown cause, Myelogram, cytometry and biopsy Bone marrow: acute myeloid leukemia. His neurologic outcome was catastrophic, with deepening coma, GCS 6 without sedation. Greater commitment of both hippocampi, stems bilateral and symmetrical bilateral mid-brain and medial temporal greater commitment to right and some cortical foci. EEG support limbic encephalitis, treated with plasmapheresis. He died from severe multiple organ failure without completing his therapy for leukemia or encephalitis.

Conclusions: In this case the difficulties are exemplified in the diagnosis and management Limbic encephalitis, which is in most cases of undiagnosed and lack of suspicion which delays the initiation of the therapy, increasing mortality when treated in state of multiple organ failure.

Keywords: Limbic encephalitis, Encephalitis no infectious
AN UNCONSCIOUS PATIENT WITH POSITIVE ANTI-GANGLIOSIDE ANTIBODY - BICKERSTAFF ENCEPHALITIS

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Introduction: Guillain-Barre Syndrome (GBS) and Miller Fisher Syndrome (MFS) is a spectrum of disorders associated with anti-ganglioside antibody. Patient suffering from this spectrum of disorder infrequently requires Intensive Care Unit (ICU) admission because of respiratory muscle weakness and/or bulbar dysfunction causing aspiration pneumonia and respiratory failure. Bickerstaff encephalitis is an even rarer subtype in the spectrum with predominate symptoms of altered consciousness caused by auto antibody attacking the reticular formation in the brain stem.

Case: A 55 years old lady with good past heath was emergently admitted to the hospital because she was found partially unarousable. She had history of upper respiratory tract infection symptoms 1 week before the hospital admission. Occasional spontaneous eye opening, reactive pupillary response and reduced extra ocular muscle movement was found in neurological examination. She was able to localize pain with grade four muscle power. She was intubated for airway protection.Computed tomography and Magnetic Resonance Imaging of brain found no abnormality. First cerebro-spinal fluid (CSF) analysis was completely normal. CSF repeated 1 week later found high protein level with normal cell count and negative microbiology result. Anti-Ganglioside antibody (Anti-GQ1b IgG) was found to be strongly positive. A 5 days course of Intra venous Immunoglobulin was given and she recovered fully after 1 month of hospitalization.

Conclusions: Although infective and vascular pathology are by far the most common diagnosis of impaired consciousness in ICU, anti ganglioside antibody test should be requested for acute autoimmune neuropathy after negative imaging and CSF analysis. Prompt immunosuppressive therapy should be seriously considered in highly suspicious cases to hasten the neurological recovery and avoid complication from prolonged ventilation.

Keywords: Neurocritical care, Altered consciousness, Bickerstaff encephalitis, Autoimmune neuropathy

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<Table 1>

<Image 1>
NASOGASTRIC TUBE SYNDROME: A RARE BUT FATAL CAUSE OF AIRWAY OBSTRUCTION

Jae Kyeom Sim, Jee Youn Oh, Kyung Hoon Min, Gyu Young Hur, Sung Yong Lee, Jae Jeong Shim, Kyung Ho Kang
Korea University Guro Hospital, Republic of Korea

Introduction: Nasogastric tube (NGT) is essential for enteral nutrition in intensive care unit (ICU) patient. Although its indwelling is easy and safe, life-threatening complications seldom occur. Here, we present a case of 86-year-old female with acute upper airway obstruction developed by NGT.

Case: An 86-year-old female was admitted to ICU for pneumonia septic shock. She had a history of hypertension, diabetes mellitus and Parkinsons disease. Nasogastric feeding was initiated on hospital day 2 and withheld from hospital day 5 through 11 due to acalculous cholecystitis while NGT was kept in place. On hospital day 13, she complained dyspnea, odynophagia and stridor. A laryngoscopic examination revealed impaired abduction of vocal cord with decreased internal diameter to 10% of normal size. We performed bronchoscopy guided intubation and percutaneous dilatational tracheostomy subsequently. A computed tomography of neck did not show any meaningful findings. We removed NGT and administered intravenous esomeprazole 40 mg and hydrocortisone 50 mg twice a day for 5 days. 15 days later, vocal cord movement returned to normal.

Conclusions: NGT syndrome, a fatal cause of airway obstruction, is rare and not widely known to clinicians. The low recognition delays the prompt diagnosis and treatment and leads to unnecessary tests. ICU patients are vulnerable to NGT syndrome because most of them receive nasogastric feeding and have a difficulty to express their symptoms. Intensivists should have a suspicion of NGT syndrome in patients with NGT and acute respiratory distress.

Keywords: Nasogastric tube, Vocal cord paralysis, Airway obstruction
CEREBRAL INFARCTION OF GUARDIANS AFTER PSYCHOLOGICAL TRAUMA

Sion Kim
Samsung Medical Center (Kangbuk Samsung Hospital), Republic of Korea

Introduction: When patients are transferred into Intensive Care Unit (ICU), their guardians emotionally suffer from the medical condition of patients. Due to such weakened state, the guardians are heavily swayed by their interaction with medical teams, especially regarding the medical state of the patient. In our case, acute cerebral infarction has been observed in right hippocampus of the guardian after being debriefed of the medical state of the patient.

Case: A 74-year-old male had been transferred into our ICU with traumatic brain injury. In his brain CT scan, traumatic subarachnoid hematoma and diffuse cerebral edema were observed. His brain was too edematous to survive, and we explained about poor prognosis to his family. His wife instantly collapsed to the floor after receiving such negative medical debriefs and sudden dysarthria was occurred. We checked her brain diffusion MRI immediately and observed acute cerebral infarction on her right hippocampus (Image 1). Except the dysarthria, other neurologic exams were intact. She was transferred to the neurologist and started antiplatelet therapy. After a month, her dysarthria was improved, yet not fully recovered.

Conclusions: Transient global amnesia is defined as sudden onset amnesia after psychological trauma. Radiological image shows tiny cerebral infarction on hippocampus which is the part of processing psychological problems (Image 2). Similarly, our patient complained dysarthria after psychological trauma and right hippocampal infarction was observed (Image 1). Our case illustrates that to prevent unnecessary secondary casualties, it is quintessential for any medical team to explain medical status of an ICU patient to his/her guardians in a delicate manner.

Keywords: Cerebral infarction, Transient global amnesia
THERE IS NO PLACE LIKE HOME-DESPERATELY SEEKING HAVEN

Nobuo Fuke\textsuperscript{1}, Hidetoshi Shiga\textsuperscript{1}, Yuki Kobayashi\textsuperscript{1}, Masaaki Miyazawa\textsuperscript{1}, Masato Fujita\textsuperscript{2}

\textsuperscript{1}Emergency & Intensive Care Center, Teikyo University Chiba Medical Center, Japan; \textsuperscript{2}Emergency Department, Azumino Red Cross Hospital, Japan

**Introduction:** Although ideal final goal of mechanical ventilation is to wean a patient from it, there are some unsuccessful cases. Those who survived acute phase of critical illness may suffer from chronic vital organ failure like chronic renal failure, chronic heart failure, or chronic respiratory failure requiring a ventilator. Once a patient is weaned from mechanical circulatory support, vasopressors, hemodialysis and establishes enteral feeding, he/she does not need ICU. Chronic care facilities for ventilator-dependent patients are quite rare in Japan and it hinders hospital bed control.

**Case:** The authors have discharged two patients who are ventilator-dependent to home in 25 years practice in ICU of a rural tertiary care hospital. One is hypoxic brain injury caused by transient cardiac arrest and he lived in unconscious status more than 10 years. Another is a case of high cervical spinal injury. The patient is conscious, tetraplegic, apneic and alive at this moment after 13 years of in-home-ventilator care. The patient has been hospitalized routinely for 14 days twice a year for respite and irregularly hospitalized due to pneumonia or cerebral infarction. The author visits her once a month to check vital condition and nurses visit more frequently.

**Conclusions:** An aging society like Japan needs medical facilities to care chronic organ failure patients.

Keywords: Post intensive care, In-home ventilator
RADIAL ARTERY PSEUDOANEURYSM AFTER ARTERIAL CATHETERIZATION FOR INVASIVE MONITORING TREATED BY COMPRESSION BANDAGE

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Chosun University College of Medicine, Republic of Korea

Introduction: Pseudoaneurysms may occur at the wrist after catheterization of the radial artery and are being increasingly reported because of widespread use of invasive monitoring. We report a case of radial artery pseudoaneurysm at the wrist related to catheterization cured by compression bandage.

Case: A 56-year-old man was referred to our hospital after a blunt abdominal injury from a motor vehicle crash. During his stay in the surgical intensive care unit, invasive hemodynamic monitoring was required via a radial artery catheter. The catheter remained in place for a total of 6 days. 10 days after operation, a painful pulsatile mass with redness was noted at the radial aspect of his right wrist. Ultrasonography identified an echoic mass measuring 11×8×7 mm, and color doppler imaging showed a swirling pattern of internal flow consistent with pseudoaneurysm of the radial artery. Formal Allens test revealed normal circulation in the right hand. Compression bandage was fashioned by applying a small rectangular pad over the swelling and wrapping the wrist with a compression bandage. Clinical and Doppler ultrasound reassessment after one week showed a decrease in size of the pseudoaneurysm and a thrombus formation. At 18 months follow up the patient remains symptom free with normal circulation of hand.

Conclusions: Compression bandage provides a simple, non-invasive procedure which may be first line treatment for uncomplicated radial artery pseudoaneurysm. In selected cases, external compression by compression bandage is a useful therapeutic option for treatment of radial artery pseudoaneurysm.

Keywords: Radial artery, Pseudoaneurysm, Catheterization, Compression
ANAPHYLACTIC SHOCK INDUCED BY INTRAVENOUS RANITIDINE: A CASE REPORT

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Introduction: Ranitidine is one of the most common used H2 receptor agonist and generally well-tolerated drug with mild side-effects. But, ranitidine-induced anaphylaxis rarely has been reported in the medical literature and the anaphylactic reaction can be life-threatening occasionally. We report a case of anaphylactic shock induced by intravenous ranitidine injection.

Case: A 42-year-old man with no history of other medications, illnesses or allergic diseases, especially to drugs, consulted our emergency department because of epigastric discomfort and right upper quadrant pain. He was given 50 mg of ranitidine as a slow intravenous bolus and 20 mg of buscopan intravenously. Within minutes of the injection, the patient developed itching, urticaria, vomiting and dyspnea. A five minute later, he had cardiac arrest and cardiopulmonary resuscitation and inotropic support were immediately commenced. Next day, he was weaned off the ventilator as he was hemodynamically stable. He made a full recovery and was discharged after 7 days.

Conclusions: This case reminds us that commonly used, generally safe drugs may on occasions cause serious adverse event and re-emphasizes the need of cautious use of drugs, even though patient has no history of allergy.

Keywords: Anaphylaxis, Ranitidine, Shock, Resuscitation
TRANSFUSION RELATED ACUTE LUNG INJURY AFTER CESAREAN SECTION DELIVERY IN A 14-YEAR-OLD PATIENT WITH HELLP SYNDROME

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Eulji University School of Medicine, Republic of Korea

Introduction: We experienced transfusion related acute lung injury (TRALI) occurred after Cesarean section delivery in a patient with HELLP syndrome.

Case: A 14-year-old primigravida was hospitalized at 34 weeks complaining of epigastric and right upper quadrant pain without dyspnea in 9 June 2014. The vital signs were blood pressure 130/80 mmHg, pulse rate 94/min, respiratory rate 20/min, and body temperature 36.9°C. And laboratory findings were proteinuria 4+, platelet 1.9×10^3/μL, lactate dehydrogenase 999 U/L, hemoglobin 10.6 g/dL, total bilirubin 1.5 mg/dL, aspartate transaminase 182 U/L, and alanine transaminase 186 U/L. On the first hospital day, she was diagnosed as HELLP (Hemolysis, Elevated Liver enzymes, and Low Platelet) syndrome, and underwent an emergency Cesarean section delivery. She was transfused 13 units of platelet concentrate, 4 units of fresh frozen plasma, 1 unit of apheresis platelet, and 2 units of packed red blood cells. About 6 hours after transfusion, dyspnea was developed suddenly, body temperature (37.7°C) was elevated and cyanosis on finger tips and lips (SpO2 60%) was noted. The chest radiograph showed bilateral lung infiltrations with pleural effusion. Echocardiogram showed that the size and systolic function of left ventricle were normal. She was completely recovered with supplementary oxygen.

Conclusions: There is no well-documented report of TRALI accompanied with HELLP syndrome. So, we report a case of TRALI after Cesarean section delivery in a 14-year-old patient with HELLP syndrome.

Keywords: Transfusion related acute lung injury, HELLP, Transfusion, Delivery
A CASE OF ACUTE CEREBRAL INFARCTION DUE TO AIR EMBOLISM FOLLOWING PERCUTANEOUS TRANSTHORACIC LUNG BIOPSY

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Soon Chun Hyang University Hospital, Bucheon, Republic of Korea

Introduction: Computed tomography-guided percutaneous transthoracic biopsy is a common procedure to diagnose mass or infection of the lung and mediastinum in the ordinary daily practice. Complications of the procedure are usually pneumothorax and hemoptysis, most of which are mild and self-limited. One of rare but fatal complications is air embolism. We experienced one case of air embolism complicating acute cerebral infarction.

Case: A 75-year-old man had been treated with active pulmonary tuberculosis for 6 months. Newly developed multiple lung nodules were detected. To rule out fungal infection, treatment failure or paradoxical reaction of tuberculosis, and malignancy, percutaneous transthoracic core-needle biopsy was done for tissue diagnosis and culture. Right after the biopsy, the patient complained of left leg numbness and weakness and gradually got drowsy. Vital signs were stable. Neurologic exam revealed left hemiplegia, and then stuporous mental change with seizure was seen. Post-biopsy CT scans showed air-fluid level in the left atrium and aorta (Image 1). Clinically, acute right middle cerebral artery (MCA) territory infarction due to air embolism was strongly suspected. Diffusion weighted image showed acute infarction (Image 2-A), and it changed to subacute stage with hemorrhagic transformation (Image 2-B).

Conclusions: Atmospheric air during stylet removal or simultaneously traversed bronchus and pulmonary vein is the mechanism. Risk factors are old age, coughing, vasculitis, and cavity. Prompt recognition, appropriate position depending on air location, and supportive care with high fraction oxygen and hydration is important. Early hyperbaric oxygen therapy is reported to facilitate absorption of oxygen and decrease ischemic damage, but there are few accessible centers in Korea.

Keywords: Percutaneous transthoracic lung biopsy, Air emboli
CLINICAL APPLICATION OF QUANTITATIVE AND WEARABLE EIT

Yoshiaki Iwashita\textsuperscript{1}, Satoru Nebuya\textsuperscript{2}, Tomotaka Koike\textsuperscript{3}, Hiroshi Imai\textsuperscript{1}

\textsuperscript{1}Emergency and Critical Care Center, Mie University Hospital, Japan, \textsuperscript{2}Graduate School of Medical Sciences, Kitasato University, Japan, \textsuperscript{3}Kitasato University Hospital, Japan

Introduction: Electrical Impedance Tomography (EIT) is a technique to obtain real-time lung tomography by measuring thoracic electrical impedance of a patient. Currently three commercial EIT systems are available in the world. However, current EIT systems have limitations in quantitative measurement and longer use. Therefore, we have been currently developing a new EIT system that capable of quantitative measurement and longer use than conventional one.

Case: Case 1. 76 years old female admitted to the ICU for septic shock due to cervical and mediastinal abscess. After surgical drainage and intensive care with broad spectrum antibiotics, she developed severe ARDS and dependent on ECMO. On day 51st of hospital admission (30th day on ECMO), we evaluated the lung tomography by using our quantitative EIT system. We evaluated lung density, which is determined by lung weight divided by lung volume. We could confirm the recruitability by evaluating the lung density. Case 2. 81 years old male presented to our hospital with bleeding shock due to rectal bleeding. He developed severe ARDS on 3rd day of hospital admission. We evaluated his lung tomography by using our wearable EIT system. EIT showed left lower lobe atelectasis and we performed recruitment maneuver. We could confirm the effect of recruitment by our EIT system.

Conclusions: Our EIT system is capable of quantitative measurement and possible longer use. We would like to measure an additional number of patients to verify the usefulness of our EIT system.

Keywords: Electrical impedance tomography, ARDS
PULMONER ALVEOLAR MICROLITHIAIS (PAM) AND EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO)

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¹Necmettin Erbakan University, Meram Medical School, Department of Anesthesiology and Intensive Care, Turkey, ²Necmettin Erbakan University, Meram Medical School, Department of Cardiac Surgery, Turkey

Introduction: PAM is an uncommon disease characterized by widespread localization of calcispherites in the alveolar spaces. Extracorporeal membrane oxygenation (ECMO) increases survival in patients with severe respiratory failure; however, prognosis is poor in cases where both ECMO and renal replacement treatment (RRT) are applied concomitantly. In this report, we present an PAM with severe respiratory case who received ECMO and RRT treatments concomitantly.

Case: A 28 year-old patient, diagnosed with PAM 14 years ago, was admitted to the hospital for dyspnea. The patient had exhibited flu symptoms for 1 week prior to his admission to the hospital. The patient had tachypnea, cyanosis and severe hypoxemia. The patient was intubated. The patient’s computerized tomography (CT) is presented in Figure 1. Adequate oxygenation could not be achieved; for this reason, ECMO treatment was initiated 12 hours later. Since the patient developed anisocoria on the second day of treatment, a cranial CT was performed (Figure 2). Since the patient also developed acute renal failure, CVVHDF was applied starting from the first day. Both ECMO and RRT were implemented concomitantly. The ECMO became coagulated on the 13th day. The patient developed hypotension and acidosis before the ECMO could be replaced, and died consequently.

Conclusions: In PAM, ECMO can be used to gain time until eliminated pulmonary infections that disrupts the oxygenation or while waiting for pulmonary transplantation. Although they requires complex care, ECMO and RRT sometimes can be used together in acute kidney injury. One of the most serious complications of ECMO should be awake are intracranial hemorrhage.

Keywords: Pulmonary alveolar microlithiasis, Extracorporeal membrane oxygenation, Renal replacement treatment

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A CASE REPORT OF SUCCESSFUL TREATMENT OF SUDDENLY OCCLUDED VASCULAR ACCESS IN A COMPROMISED PATIENT

Keisuke Koyama, Naoya Kobayashi, Yuichi Kobashi, Yoichiro Kikuchi, Shiro Hanakawa, Suemi Kondo, Michioki Tano, Tomohisa Yokoyama, Yoshinori Ariyasu, Takashi Fujiwara, Ryo Shibata, Kohei Takikawa, Hiroyuki Ishihara, Emiko Suzuki, Ryoma Sugita

Okayama Saidaiji Hospital, Japan

Introduction: Management of vascular access (VA) is important in hemodialysis patients. We regularly perform ultrasonography (US) and clearance gap (CL-Gap) measurement in order to prevent occlusion of VA. In spite of such efforts, unfortunate occlusion of VA in compromised patients is suddenly occurred. We here introduce a successful treatment of such VA occlusion.

Case: A 63-year-old male dialysis patient suffering C type liver cirrhosis was hospitalized due to a thoracic vertebra pressure bone fracture. At admission, no stenosis of VA was detected. Changes in CL-Gap or systematic blood pressures were observed. Two months after admission, sudden occlusion of VA was occurred by thrombus formation. Percutaneous thrombectomy was successfully performed, but the following balloon dilation could not improve VA stenosis. Thus, surgical resection was finally conducted. Histologically, the vessel wall intima thickened markedly.

Conclusions: Hemodialysis patients of the elderly and compromised person will increase in near future. It is necessary to develop the minute team medical care that includes frequent confirmation of VA sound, US examination, and report about vital changes in the hospital ward with keeping in mind that the elderly compromised patients have high possibility to occur sudden VA occlusion.

Keywords: Hemodialysis, Vascular access, Ultrasonography
AN ADULT CASE OF THROMBOTIC MICROANGIOPATHY DUE TO NON-SHIGA TOXIN ESCHERICHIA COLI ASSOCIATED ENTEROCOLITIS SUCCESSFULLY TREATED WITH ECULIZUMAB

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Introduction: Atypical hemolytic uremic syndrome (aHUS) is a thrombotic microangiopathy (TMA) associated with a disorder in complement alternative pathway regulation. Eculizumab is a monoclonal complement C5 antibody which prevents the induction of the terminal complement cascade. We present a case of TMA successfully treated with eculizumab.

Case: A 68-year-old man presented the previous hospital with jaundice and abdominal pain after a 2-week history of bloody stool. Laboratory examinations revealed anemia, thrombocytopenia and renal insufficiency. He was started on empiric antibiotic therapy for intra-abdominal infection. His condition aggravated, therefore, he was transferred to our ICU and was introduced continuous hemodiafiltration. However, his urine output gradually decreased, and schizocyte was observed in his peripheral blood smear on 9th day after transfer. Plasma exchange (PE) against TMA was initiated, however, he was still suffering from oliguria and thrombocytopenia even after 8 times of PE. Subsequently, it was found that ADAMTS13 activity was 25% and Shiga toxin Escherichia coli (STEC) was negative in his stool on admission. He was suspected of having aHUS and was started on eculizumab, which improved renal insufficiency and thrombocytopenia dramatically. In his serum sample, complement factor H (CFH) antibody titer was negative. However, it was found that slight hemolysis of sheep erythrocytes was observed to some extent in contact with his plasma. A definitive diagnosis was not established although it was suspected that his pathogenesis might be caused by the functional defect associated with CFH-related abnormalities.

Conclusions: We reported the case of TMA, suspected of aHUS, who responded rapidly to eculizumab.

Keywords: Atypical hemolytic uremic syndrome, Eculizumab, Thrombotic microangiopathy, Thrombocytopenia
EMPHYSEMATOUS PYELONEPHRITIS PRESENTED AS AN ACUTE ABDOMEN WITH PNEUMOPERITONEUM: A CASE REPORT

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Introduction: Emphysematous pyelonephritis is a severe, life-threatening infection of the renal parenchyma and perinephritic tissues. We describe a case of emphysematous pyelonephritis presented as an acute abdomen with pneumoperitoneum.

Case: A 72-year-old woman with a past medical history of diabetes, hypertension, and renal calculi was referred to our emergency department with 6 days of abdominal pain. Initial vital signs showed a blood pressure (BP) of 140/90 mmHg, heart rate of 120 beats per minute, temperature of 37.9°C. Direct tenderness was diffuse but most prominent in the right upper quadrant. Laboratory test revealed a platelet count of 17,000/mm³, creatinine level of 1.64 mg/dl, BUN of 44.4 mg/dl and serum glucose level of 603 mg/dl. An abdominal computed tomography scan showed free air in intraperitoneal cavity and right perirenal space (Image 1). The patient was immediately taken to the operation room for laparotomy. On exploration of the abdomen, 1.5 L of pus color fluid was evacuated. Inspection of the abdominal viscera and pelvic organ did not identify a site of perforation. In superior border of right kidney, necrosis of tissue and perforation site was found (Image 2). She was done right radical nephrectomy for the treatment of emphysematous pyelonephritis. After operation, the patient was then admitted to our intensive care unit for postoperative management. A follow-up CT scan after 10 days showed fluid collection and hemorrhage in the nephrectomy site. Percutaneous drainage was performed. Fluid collection was nearly disappeared at 3 weeks later.

Conclusions: An aggressive surgical treatment combined with intensive antibiotic therapy is lifesaving.

Keywords: Emphysematous pyelonephritis, Diabetes, Renal calculi
LANE-ADAMS SYNDROME: POSTHYPOXIC MYOCLONUS WITH A GOOD PROGNOSIS

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Introduction: Lance-Adams syndrome (LAS) was first described in 1963 in a patient after cardiac arrest. So far less than 150 cases have been described in literature. LAS is described as a posthypoxic intentional myoclonus with a good prognosis. Patients survive with an unchanged or practically unchanged mental ability, intentional myoclonus and problems with balance may persist. Myoclonic epileptic status (status myoclonus) (MSE) is a clinical phenomenon associated with a very poor neurological outcome. The main difference between LAS and MSE is the state of consciousness. Patient with MSE is in a deep coma, patient with LAS is conscious (and sedated). There is supposed to be a difference in the onset of these symptoms which is described in the terminology: MSE - acute posthypoxic myoclonus and LAS - chronic posthypoxic myoclonus. But myoclonus with a good functional outcome (and therefore LAS) can develop as early as 24 hours after cardiac arrest. Therapeutic hypothermia with the need for sedation modifies the clinical course and makes an early differential diagnosis between these two syndromes very difficult. Clinical symptomatology is in patients on sedation and antiepileptic therapy hard to interpret. Even EEG is in these situations hard to analyse.

Case: We would like to present 3 case reports of patients with LAS.

Conclusions: Early status myoclonus is associated with a poor neurological outcome and is cited as such in many guidelines. Lance-Adams syndrome (myoclonus with a good prognosis), although much less frequent, must always be considered in patients after cardiac arrest.

Keywords: Lance-Adams syndrome, Cardiac arrest, Myoclonus
ALARMING COMPLICATION OF CHEST COMPRESSION IN OUT-OF-HOSPITAL CARDIAC ARREST

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**Introduction:** It is well recognized that the survival rate of cases with out-of-hospital cardiopulmonary arrest (OHCA) is getting better, because of wide spread of cardiopulmonary resuscitation (CPR). On the other hand, we have experienced some cases of alarming complications associated with chest compression.

**Case:** The patient was a 60s male, who developed ventricular fibrillation (VF) due to acute myocardial infarction. Providing CPR for him, we performed percutaneous coronary intervention (PCI) successfully. Nevertheless, After PCI, his hemodynamics worsened again because of cardiac tamponade. We diagnosed cardiac rupture occurred and performed surgical repair. Multiple fractures of costal cartilages, perforation of anterior wall of right ventricle, injuries of coronary artery and left internal thoracic artery were recognized. Another patient was 50s male suffering from hypertrophic cardiomyopathy. He fainted due to VF and was received bystander CPR. Because refractory VF was sustained, we inserted percutaneous cardiopulmonary support device. Nevertheless, his hemodynamics was unstable and echocardiogram revealed cardiac tamponade. Sternal fracture and perforation of right atrium associated with CPR was identified, and surgical repair was done. Patients of OHCA admitted in our hospital during 2010-2013 were 1671 cases, and 314 cases of them were could be resuscitated. Complications of chest compression were recognized in 5 cases of the resuscitated cases.

**Conclusions:** Although mechanical heart injuries as complication of CPR thought to be rare, we should pay attention to these complications.

Keywords: Out-of-hospital cardiopulmonary arrest, Cardiopulmonary resuscitation, Cardiac tamponade, Complication
RECURRENT SUBCUTANEOUS EMPHYSEMA FOLLOWING SURGICAL TRACHEOSTOMY: A CASE REPORT

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Introduction: We report a case of recurrence of subcutaneous emphysema associated with surgical tracheostomy. The mechanisms and management plans for this rare complication are discussed.

Case: An adult female patient diagnosed with hypoxic brain injury underwent surgical tracheostomy. After ten hours of mechanical ventilation, subcutaneous emphysema and hypoxemia occurred. Accidental decannulation was diagnosed and orotracheal intubation was undertaken following removal of a tracheal cannula. The skin over the tracheostomy was sutured. Pneumothorax was also noted and managed with chest drainage. Subcutaneous emphysema and pneumothorax improved rapidly. However, subcutaneous emphysema worsened on day five. Exploration of the surgical site revealed air leakage through incision of tracheal anterior wall created during tracheostomy procedure. Therefore the skin wound was left open and the subcutaneous emphysema resolved. The patient underwent surgical tracheostomy again on day seven, and adverse events associated with tracheostomy were not experienced thereafter.

Conclusions: The mechanism for reappearance of subcutaneous emphysema in our case was closure of the skin over the tracheostomy site without closure of the underlying tracheal incision, through which air leaked into subcutaneous tissues. It is well known that reinsertion of a tracheal cannula needs extreme attention in early days after tracheostomy and therefore orotracheal intubation remains the mainstay of airway management in cases like ours. But how to manage the wound of a newly tracheostomatised patient whose tracheostomy cannula was replaced with orotracheal tube is not often mentioned. We learned from this case not to close newly created tracheostomy after removal of a tracheostomy cannula.

Keywords: Tracheostomy, Subcutaneous emphysema, Accidental decanulation
EFFECTIVENESS OF POLYMYXIN-B (PMX-B) HEMOPERFUSION IN SEPTIC SHOCK PATIENTS

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Introduction: PMX-B-immobilized fiber column (Toraymyxin, Toray Medical Co Ltd, Japan) has been developed in Japan for the purpose of selectively adsorbing circulating endotoxins. We report the effect of using PMX-B hemoperfusion restore the hemodynamic status and improve the outcome in two critically ill patients.

Case: Case 1: A 71 y old male was admitted to ICU with septic shock after emergency operation due to bowel perforation. APACHE II was 33, he was highly vasopressor dependent, and developed MOF. PMX-B hemoperfusion was started in 14th h of ICU admission. His blood culture came positive for Gram (-) bacteria. The patient extubated in the 4th day, and discharged from ICU in the 25th day. Case 2: A 54 y old male was admitted to ICU with severe sepsis due to urinary tract infection, and severe pneumonia. In the 2nd day septic shock has been developed. He was highly vasopressor dependent, and MOF has been developed. In the 14th hour of septic shock PMX-B treatment has been started. The blood, and BAL cultures were positive for Gram (-) bacteria. The patient has been extubated in the 6th day, and discharged from ICU in the 14th day.

Results: Summarized in table.

Conclusions: We consider Polymyxin B hemoperfusion is useful for improving the hemodynamic status, and outcome when performed in early stage of sepsis.

Keywords: Polymyxin B hemoperfusion, Sepsis

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
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<td></td>
<td>Treatment</td>
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<td>Procalcitonin (mg/L)</td>
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<tr>
<td>Noradrenaline (micg/kg/min)</td>
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</table>

<Table 1>
EXTRACORPOREAL LIFE SUPPORT FOR PEDIATRIC SUDDEN CARDIAC ARREST CAUSED BY WOLFF-PARKINSON-WHITE SYNDROME

Kyoung Hwan Song, Byung Kook Lee, Kyung Woon Jeong
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Introduction: Wolff-Parkinson-White (WPW) syndrome presents good prognosis. But several patients suffered malignant arrhythmia or sudden cardiac death (SCD). Several cases were reported the SCD in WPW syndrome patient. However, successfully completed extracorporeal life support in pediatric cardiac arrest by WPW syndrome has not been reported so far.

Case: A 13-year-old girl with no history of cardiovascular disease sudden collapsed. The patient was taken cardiopulmonary resuscitation approximately eighty minutes. However, refractory ventricular fibrillation noted and the patient shows movement of her arm. We decided to perform ECLS. On hospital day 4, the patient was successfully weaned off Extracorporeal membrane oxygenator. On electrophysiologic study showed parahisian pathway. Therefore, intracardiac defibrillator was inserted instead of radiofrequency ablation. The patient was discharged without neurologic complication.

Conclusions: ECLS can be helpful in treatment of pediatric OHCA. Therefore, ECLS could be considered for treatment of refractory VF in pediatric OHCA.

Keywords: Pediatrics, Wolff-Parkinson-White syndrome, Resuscitation
MASSIVE INTRACRANIAL HEMORRHAGE IN METHANOL INTOXICATION

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Introduction: Methanol, through its chief metabolite, formate, causes irreversible neurological damage such as basal ganglia ischemia or hemorrhage. We report the unusual brain CT findings with falx and tentorial hemorrhage in a patient poisoned by methanol.

Case: A 32-year-old man presented with altered mental status and high anion gap metabolic acidosis. Serum methanol level was (641.5 mg/l) significantly elevated. The patient was immediately treated with hemodialysis (HD) and intravenous fomepizole. However, bilateral basal ganglia hemorrhage with tentorial, and falx hemorrhage, an uncommon serious complication during HD, was observed. Unfortunately, patient died 3 weeks after methanol poisoning.

Conclusions: Clinicians should have high index of suspicion for basal ganglia, falx, or tentorial hemorrhage when patient presents with altered mental status and severe acidosis after methanol poisoning. Cerebral hemorrhage at multiple sites may predict a poor outcome in patients with methanol poisoning.

Keywords: Methanol, Intracranial hemorrhage, Hemodialysis
SEROTONIN SYNDROME PRECIPITATED BY A COMBINATION OF BUPROPION AND SSRIS: A CASE REPORT

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¹Hallym University College of Medicine, Republic of Korea, ²Hanyang University College of Medicine, Republic of Korea

Introduction: Serotonin syndrome is caused by supratherapeutic doses of a single selective serotonin reuptake inhibitor (SSRI) and/or the combination of two or more serotonergic agents. Among several causative drugs, the potential role of bupropion in serotonin syndrome has rarely been reported.

Case: A 19-year-old male soldier serving a military service was found unconscious at a military camp and transported to the emergency department (ED). The patient looked drowsy and showed a partial response to the questions asked. Several abnormal clinical findings were observed: tachycardia, high blood pressure, dry oral mucosa, dry skin, drowsy mental state, mild dilated/reactive pupils and symmetrically increased DTR on the knee jerk. In addition, his creatine phosphokinase (CPK) level increased up to 6972 U/L. However, other laboratory findings, including brain MRI and CT, were unremarkable. In a few hours, his mental status became clearer but all at sudden, he started to show delirium as well as other neurologic abnormalities, such as resting tremor and gait disturbance. By the supportive care, his vital signs and mental status became normal on the hospital day 3 and he was discharged on day 7. He manifested that when attempting suicide, he took the medications (7 mg lorazepam, 140 mg paroxetine and 1050 mg bupropion) gathered by himself all at once.

Conclusions: An acute overdose of bupropion and SSRI (paroxetine) can cause serotonin toxicity.

Keywords: Serotonin syndrome, Bupropion, Serotonin uptake
A CASE OF SEVERE METHEMOGLOBINEMIA DUE TO SODIUM NITRITE POISONING

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Introduction: Methemoglobinemia may result from an exposure to oxidizing agents, such as nitrites, and reduces the oxygen-carrying capacity of the blood. It is reported that methemoglobin levels of 10% to 25% produce cyanosis, 35% to 40% produce mild symptoms (e.g., dyspnea), 60% produce lethargy and coma, and ≥ 50% are lethal.

Case: A 28-year-old man was brought to our emergency department in an unconscious and cyanotic state. His skin was blue, and blood oxygen saturation could not be determined on pulse oximetry. His methemoglobin level was 92.5% on arterial blood gas analysis. First, the patient was intubated and ventilated with 100% oxygen; then, we intravenously administered methylene blue (2 mg/kg) over 5 min. Soon after the administration of methylene blue, the patient's skin regained a normal pinkish hue and methemoglobin levels showed a decreasing trend on arterial blood gas analysis. The patient was transferred to an intensive care unit where he regained consciousness and admitted that he had consumed approximately 15 g of sodium nitrite about 1 hour before he was brought to our hospital. On the following day, diffusion-weighted magnetic resonance imaging of the brain revealed high attenuation in the globus pallidus bilaterally, which was similar to that observed in patients with carbon monoxide intoxication.

Conclusions: It is very important to correctly diagnose methemoglobinemia and promptly initiate treatment with methylene blue. Only a few cases with such high levels of methemoglobin have been reported in the literature.

Keywords: Methemoglobinemia, Sodium nitrite
A FATAL CASE REPORT IN CHLORFENAPYR POISONING

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Introduction: Chlorfenapyr is a widely used as insecticide; they have a high degree of human toxicity with uncoupling oxidative phosphorylation within the mitochondria, consequently inhibits adenosine phosphate production. Despite its widespread use, acute human poisoning data are insufficient.

Case: A 74-year-old man who attempted suicide by ingesting 100～200 ml of chlorfenapyr, was transferred from other hospital to our hospital by an ambulance. On admission, he complained of severe diaphoresis and nausea, but his vital signs were almost stable. As gastric lavage had been already done at other hospital, we treated him with intravenous fluid and activated charcoal administration. As there are few reports of an effective therapy on chlorfenapyr, one day after admission, continuous hemodialysis (HD) for 24 hours and plasma exchange (PE) for 8 hours per day were performed for three days. After these therapies, we started the continuous hemodiafiltration (CHDF) for 24 hours. The signs of nausea disappeared on the second day, but severe diaphoresis continued until the 4th day. On the 5th day of the admission, the patient remained confused and disoriented and then lost consciousness. Soon after, he showed signs of sudden cardiac arrest. Advanced cardiac life support was performed, but he finally expired.

Conclusions: A fatal case of chlorfenapyr poisoning is described. Treatment of chlorfenapyr poisoning is essentially supportive and there are few reports of an effective therapy on chlorfenapyr. In this case, acute blood purification therapy such as HD and PE was ineffective. Further work on the clinical effects of chlorfenapyr is required.

Keywords: Chlorfenapyr, Poisoning, Insecticide, Suicide
PERSISTENT HYPOGLYCEMIA DEVELOPING DUE TO SULPHONYLUREA POISONING

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Introduction: Sulphonylurea group drugs are commonly used in the treatment of hyperglycemia in type 2 Diabetes Mellitus. A common side effect due to the use of sulphonylurea is persistent hypoglycemia.

Case: A 24 year-old female patient attempted suicide taking 240 tablets gliclazide (7200 mg), and 24 tablets acetylsalicylic acid (3600 mg) orally and when she was brought to the emergency room 2 hours later, she was drowsy. Gastric lavage was performed and activated charcoal was given. Then the patient was admitted to the ICU. The glucose meter result showed that the blood glucose value was 24 mg/dL. Immediately, 50 ml 50% dextrose was given intravenously as it would be completed in 10 minutes. After that, in order to keep the blood glucose level within normal limits, 20% dextrose infusion was started as 50 ml/hour. The blood glucose level was measured every half an hour and every time the glucose meter showed that the level was ≤ 50 mg/dL, 50 ml of 50% dextrose was given as it would be completed in 10 minutes in addition to the continuing infusion. The treatment schedule of the patient was continued this way until the 3rd day. However, in the afternoon of the 3rd day, the blood glucose level of the patient returned to normal. On the 7th day, the patient was discharged.

Conclusions: We are of the opinion that the blood glucose level should be followed-up as closely as possible until hypoglycemic attacks are eliminated.

Keywords: Sulphonylurea, Poisoning, Hypoglycemia
CLONIDINE POISONING IN A PEDIATRIC PATIENT

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**Introduction:** Clonidine is a central alpha-agonist that is used as an antihypertensive agent. Other reported clinical uses include treatment of opiate and alcohol withdrawal and control of atrial fibrillation with a rapid ventricular rate.

**Case:** A 4 year-old female patient weighing 12 kg and brought to the emergency room by her family had lethargy and myosis symptoms. It was reported that about 2 hours prior to her arrival at the emergency room, the family found the patient holding a clonidine package, 2 tablets (total 0.2 mg) of which were missing and 1 hour later, she was drowsy and pale. The patient started to lose consciousness. Respiratory distress and bradycardia (< 60/min) was observed. The patient was intubated and 0.5 mg IV atropine was administered, gastric lavage was performed, and activated charcoal was given. As no changes occurred in the state of the patient who was followed-up for some time, she was extubated. The next day, persistent bradycardia and intermittent apnea episodes developed and sPO2 value dropped down to 85%; thus, the patient was reintubated and mechanical ventilation was administered. In the period from the 3rd day to the 9th, extubation-reintubation processes were repeated a few times. The patient gradually got better and was discharged on the 16th day.

**Conclusions:** We are of the opinion that when the sPO2 values fall below certain limits, the patient should immediately be intubated, and the period of intubation should be as short as possible in order to be able to avoid the complications that intubation may cause.

Keywords: Clonidine, Poisoning, Bradycardia
ACUTE SODIUM CHLORIDE POISONING DUE TO MASSIVE SALT INGESTION

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Introduction: Intentional massive sodium chloride ingestions are rare occurrences and are often fatal. We report a case of fatal salt poisoning in a 36-year-old woman who suffered from schizophrenia and ingested a large amount of table salt.

Case: She transferred to our ICU in a comatose state about 8 hours after ingesting a 200 g salt. Serum sodium was 192 mmol/L, blood osmotic pressure was 385 mOsm/L on admission. Head CT scan showed subarachnoid hemorrhage on the right temporal lobe. Immediately after admission, she was administered massive fluid therapy. After 12 hours from admission, serum sodium levels decreased 170 mEq/L (1.83 mEq/L/hour). However, comatose state continued. At day 2, head CT scan showed diffuse brain edema. She was also performed electroencephalography and this wave pattern was already almost all flat, and mydriasis was presented. She was transferred general ward at day 30, and died at day 37.

Conclusions: There are a variety of treatment recommendations for hypernatremia. However, there are no determination of medical treatment policies at the correction of hypernatremia yet. In potential management strategy for acute severe hypernatremia, emergency physicians and intensivists need to consider not only intravenous fluids therapy but also the treatment of additionally rapid massive compensation of serum sodium (e.g. hemodialysis) for minimizing of brain damage.

Keywords: Salt poisoning, Brain damage, Therapy
**MANAGEMENT OF CYANIDE INTOXICATION SUPPORTED BY EXTRACORPOREAL MEMBRANE OXYGENATION**

**Jin Park, Hyun-sik Choi, Youn-hee Choi, Young-joo Lee**

_Ewha Womans University Mokdong Hospital, Republic of Korea_

**Introduction:** Cyanide intoxication is occurred through various routes of industry in a number of chemical processes such as electroplating, metal refinery, accidently food intake, and for suicide. Indications of extracorporeal membrane oxygenation (ECMO) are expanding for various patients even in intoxicated case with reversible cardiac dysfunction. Herein, we present a male patient who went down with refractory metabolic acidosis after cyanide intake and recovered by antidote during maintenance of cardiac function by ECMO.

**Case:** A 50-year-old male patient with a history of depression was arrived Emergency room for mental change after ingestion of cyanide for suicide attempt 30 minute ago. He was coma and brain stem reflex were absent. Physical examination showed pinkish skin. Initial laboratory analysis demonstrated severe metabolic acidosis with increased lactic acid 25 mmol/L. Although large mount of fluid resuscitation with 1.0 g/kg/min of norepinephrine, mean arterial blood pressure was below 50 mmHg and acidosis was not corrected though continuous renal replacement therapy. We decided to apply ECMO for gaining time until stable hemodynamic status. Sodium nitrate, sodium thiodulfate infusion start after 8 hours, then vital sign was improved to mean BP of 80 mm Hg along with correction of acidosis.

**Conclusions:** We report a male patient who showed typical cyanide intoxication as lethal metabolic acidosis and cardiac impairment and recovered by antidote during maintenance of cardiac function by ECMO.

Keywords: Cyanide intoxication, Extracorporeal membrane oxygenation (ECMO)
EXTRACORPOREAL MEMBRANE OXYGENATION FOR 67 DAYS AS A BRIDGE TO HEART TRANSPLANTATION

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Samsung Medical Center (Samsung Seoul Hospital), Republic of Korea

Introduction: We report a case of successful heart transplantation after 67 days of support with venoarterial extracorporeal membrane oxygenation (ECMO) in a patient who had surgery for type A aortic dissection and myocardial infarction that was complicated by irreversible myocardial damage and a deep sternal wound infection.

Case: A 44-year-old female (170 cm, 65 kg) with a family history of Marfan syndrome had been inserted with venoarterial type ECMO due to cardiac arrest caused by acute type A aortic dissection, and she underwent emergency Bentall operation plus coronary artery bypass grafting. Despite surgery, she was kept on VA ECMO because of extensive myocardial damage. On ECMO day #16, we brought her to the operating room and found that the mediastinal space was filled with pus. The identified organism was MRSA and vancomycin was used for treatment. On ECMO day #19, a left ventricular vent cannula was inserted via right anterior thoracotomy due to progression of pulmonary edema. A total of 139-unit packed RBC was transfused during ECMO period. Oxygenators and pump heads were repeatedly replaced. On ECMO day #65, heart transplantation was performed. ECMO could be detached from the patient on ECMO day #67. She was discharged home on ECMO day #110 after rehabilitation.

Conclusions: With ECMO for 67 days, we successfully managed a patient with massive myocardial infarction and deep sternal wound infection after surgery for type A aortic dissection. Although those conditions were significant challenges, we successfully bridged the patient to heart transplantation.

Keywords: Extracorporeal membrane oxygenation, Heart transplantation
FIXED PUPILLARY LIGHT REFLEX DUE TO PERIPHERAL NEUROPATHY AFTER LIVER TRANSPLANTATION: A CASE REPORT

Sung Yeon Ham, Jeongmin Kim, Sungwon Na

Severance Hospital, Republic of Korea

Introduction: Abnormal pupillary light reflex usually indicates neurologic emergency in the patients who undergo liver transplantation, but benign neurologic disorders such as peripheral autonomic neuropathy or Holmes-Adie syndrome (HAS) should be considered. We report a patient with fixed pupillary light reflex after liver transplantation diagnosed with peripheral autonomic neuropathy.

Case: A 46-year-old female patient with diabetes and B-viral liver cirrhosis was admitted to the intensive care unit (ICU) after liver transplantation. She got a falling accident a month before and had intracranial and subarachnoid hemorrhage which was spontaneously resolved (Fig. 1). On arrival at ICU, she had isocoric pupil and sluggish pupillary light reflex. Sedation was started with propofol and remifentanil. About an hour later, no pupillary light reflex was observed and both pupils were fixed. On brain CT scan, there was no newly developed lesion but still remaining previously noted trauma associated hemorrhages (Fig. 1). Neurologic examination showed absent deep tendon reflexes at the knees and ankles. She was arousable 1.5 hours after discontinuation of sedatives and extubated successfully after 12 hours. The pupils remained unchanged for several days. Pupils were constricted after instillation of 1% pilocarpine but not constricted with 0.125% pilocarpine (Fig. 2). Consequently, we could rule out the initially suspected HAS. Pupillary constriction to 1% pilocarpine implies third nerve lesions and we could suspect generalized peripheral or autonomic neuropathy.

Conclusions: Peripheral neuropathies observed frequently in patients with end-stage liver disease can mimic neurologic emergency presenting fixed pupillary light reflex. We suggest that preoperative neurologic evaluation should be performed before liver transplantation.

Keywords: Holmes-Adie syndrome, Peripheral nervous system
RARE CASE OF MASSIVE HEMOTHORAX DUE TO CENTRAL VENOUS CATHETERIZATION TREATED WITH ANGIOGRAPHIC STENT IMPLANTATION

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Introduction: Central venous catheterization is widely used procedure. In surgical patients, central venous catheterization is performed for massive fluid resuscitation in hypovolemic shock, massive transfusion, total parenteral nutrition, central venous pressure monitoring, and hemodialysis and so on. But, many complications are developed in central venous catheterization. These complications are pneumothorax, hemothorax, hematoma, hydrothorax, hydromediastinum, air embolism, thrombosis, infection and myocardial puncture. Among these complications, hemothorax is rare but fatal complication when developed.

Case: A 32-year-old woman presented with ongoing vaginal bleeding after normal vaginal delivery. There was subclavian artery bleeding into the thoracic cavity in angiography. Therefore, stent-graft was implanted. After implantation of stent graft, angiography showed that no more bleeding was we present a rare case of massive hemothorax during central venous catheterization. We successfully treated with angiographic stent graft implantation.

Conclusions: Multicenter study and consensus should be needed to decide proper treatment for hemothorax due to central venous catheterization.

Keywords: Hemothorax, Central venous catheterization, Angiographic stent-graft
BRONCHOPLEURAL FISTULA DUE TO SEVERE BLUNT TRAUMA OF THE CHEST; DIAGNOSTIC BRONCHOSCOPY: A RARE FINDING

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Introduction: Bronchopleural fistula is communication between the pleural space and the bronchial tree. BPF represent a challenge, both for their diagnosis and treatment. Early bronchoscopic examination and chest X-ray are the important part of investigations in emergency. Intercostal chest tube drainage is the first line of treatment to relieve respiratory distress in the chest trauma cases. We encountered a case of right BPF which diagnosed with the use of fiberoptic bronchoscopy.

Case: A 22-year-old gentleman involved in a car accident. He was diagnosed with right pneumothorax and intercostal chest tube inserted in emergency department. Subsequently he was having respiratory distress with massive subcutaneous emphysema which required an intubation. Post-intubation there was continuous massive air leak in the intercostal drainage, present throughout the respiratory cycle. Alarmed by the mounting respiratory distress, urgent bronchoscopy was done using a 6-mm diameter bronchoscopy which demonstrated an abnormal looking crescent shaped opening between the middle and lower lobe of the right lung. Upon advancing the scope further through the opening, the rib cage and 2 ICT was clearly visualized. Therefore it was confirmed that the patient had a bronchopleural fistula of the right bronchus secondary to severe blunt chest trauma.

Conclusions: BPF is associated with significant morbidity and mortality. Diagnosis and treatment of life threatening complications should be instituted as early as possible. A fiberoptic bronchoscopy known to be a reliable tool to diagnose BPF. The management of a large BPF (> 5 mm) is surgical. In cases of smaller (< 5 mm) fistula, a bronchoscopic closure can be attempted.

Keywords: Bronchopleural fistula, Fiberoptic bronchoscopy

Figure 1

Figure 2
STAB INJURY AND PSEUODOANEURYSM OF THE SUPERIOR MESENTERIC ARTERY: SURGICAL AND ENDOVASCULAR TREATMENT

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Introduction: Superior mesenteric artery (SMA) injuries remain a challenge to the most trauma surgeon and continue to carry a significant mortality in spite of aggressive management.

Case: We report a case of successful management for the proximal SMA injury with life threatening bleeding and its pseudoaneurysm after incipient laparotomy in a 56-year-old man with stab injury to the epigastrium. He underwent an emergency primary repair of penetrated wall of stomach and an exploration of the mesenteric root with hematoma on an injury day. Computed tomography (CT) on post-injury day (PID) 1 due to the massive bloody drain of the abdomen showed an extravasation on the right side of the SMA trunk. A reoperation was immediately performed to achieve bleeding control with primary arterioorrhaphy. A follow-up abdominal CT angiography on PID 6 showed a pseudoaneurysm on the left side of the SMA trunk. A covered stent was inserted percutaneously to exclude the pseudoaneurysm.

Conclusions: Aggressive management of patient with a penetrating injury to the proximal SMA could offer the chance of survival by surgical or endovascular intervention.

Keywords: Stab injury, Superior mesenteric artery
TEMPORARY CLOSURE FOR STERNOTOMY IN PATIENT WITH MASSIVE TRANSFUSION MIGHT BE LETHAL

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Introduction: This article reports lethal bleeding at sternotomy site with temporary closure (TC) in disseminated intravascular coagulopathy (DIC) patient from massive transfusion.

Case: A 58-year-old male visited emergency room for multiple traumas from explosion. On initial evaluation, hemopneumoperitoneum with liver laceration (grade 4), colon perforation was identified. Hemopericardium with cardiac tamponade was also identified. Shrapnel was detected at right ventricle (RV) (Image 1). Damage control surgery was planned due to hypotension. In operation room, Bleeding was controlled after sternotomy, pericardiotomy and laparotomy. Massive transfusion about 60 units was done during operation. After gauze packing, operation was finished with TC (Image 2). Sanguineous fluid was drained profusely. DIC was confirmed at laboratory findings. No extravasation was found at hepatic angiogram. On re-operation, there was no active bleeding also but oozing from sternotomy site was identified. Bone bleeding was impossible to control. Finally operation was ended after gauze packing and TC again. The patient could not survive only one day after re-operation.

Conclusions: For critically ill patient, damage control surgery was usually performed and ended with TC to prevent acidosis, hypothermia and coagulopathy. But after massive transfusion, DIC might occur easily. In this situation, TC after sternotomy in patients with massive transfusion might be lethal, because bone bleeding from sternotomy wound might be hard to control owing to DIC. In conclusion, authors recommend that TC after sternotomy in patient with massive transfusion should be carefully decided.

Keywords: Trauma, Damage control surgery, DIC, Temporary closure
CONTRALLATERAL TRAUMATIC ICA OCCLUSION TREATMENT MODALITY AFTER POSTCRANIECTOMY

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Introduction: The incidence of carotid injury in association with head injury is reported to be between 0.05～0.5%. These injuries are generally missed on initial examination unless one is aware and vigilant. Traumatic ICA occlusion treatment option is anticoagulant, thrombectomy, STA-MCA bypass. We are reporting a case ICA thrombosis associated with head injury and treatment modality in postcraniectomy liver cirrhosis patient.

Case: 67 year old liver cirrhosis patient admitted after pedestrian traffic accident. When seen at our hospital his GCS was 12/15, normal pupillary size and reflex, motor grade all grade IV positive. There was no neck injury. CT showed F-T-P subdural hematoma left and then craniectomy with subdural hematoma removal was done. Postoperative 1 day, newly developed large amount ICH temporal left and then hematoma removal was done. Post operative 6 day, neurologically left side weakness aggravated (Grade IV → I). CT showed right mca territory low density and MRI showed mca territory infarction and occlusion of ICA right. We cannot try thrombectomy due to various complication or situation (hyperperfusion syndrome, severe ICA stenosis, anticoagulant medication, heparin use) and low density mca territory at CT scan. We performed emergent sta-mca bypass.

Conclusions: ICA occlusion treatment modality is anticoagulation, thrombectomy, STA-MCA bypass. STA-MCA bypass is a tolerable treatment option for postcraneectomy patient underlying liver cirrhosis due to various complication or situation.

Keywords: Traumatic occlusion, STA-MCA bypass, Liver

<Image 1>

<Image 2>
MULTIPLE CEREBRAL INFARCTION DUE TO TRAUMATIC VERTEBRAL ARTERY DISSECTION AFTER CERVICAL FRACTURES

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Introduction: Traumatic vertebral artery dissection (VAD) is a rare event after cervical spine injury. Unilateral VAD does not usually cause symptomatic ischemic stroke. We report a case of multiple symptomatic cerebral infarction from traumatic VAD after cervical fractures.

Case: A 73-year-old man was admitted with stuporous mentality, left hemiparesis after motor-vehicle accident. Brain CT on diagnosis showed traumatic subarachnoid hemorrhage on left parietal lobe. Brain MRI revealed acute, multiple cerebral infarction including pons, midbrain, thalamus, frontal lobe on diffusion weighted images (Fig. 1). Cervical CT showed left lateral mass fractures on C2, C5, and C6. Cervical MRI revealed loss of signal void on left vertebral artery (Fig. 2). Neck CT angiography showed left VAD starting at the C5 level. The patient was treated conservatively at the intensive care unit in the acute stage to prevent extent of stroke. Aspirin was started for antiplatelet therapy in the chronic stage.

Conclusions: We should consider the possibility of symptomatic cerebral infarction due to traumatic VAD following cervical fracture.

Keywords: Vertebral artery dissection, Cervical fracture
POLYTRAUMA AND TRACHEAL RUPTURE

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Introduction: The initial management of the poly-trauma patient is of vital importance to minimizing both patient morbidity and mortality.

Case: A 21-year-old female patient was brought to the emergency room after an in-vehicle traffic accident. She was in an unconscious state with impaired cooperation and orientation; Glasgow Coma Score was 5 and she had been intubated. Urgent splenectomy was performed. During the operation, the left diaphragmatic rupture was found, fixed and a chest tube was placed. The patient was sent to ICU. On the 3rd day, a chest tube was placed as a result of the right pneumothorax diagnosis. Due to the high amount of drainage in the chest tubes and pyrexia of unknown origin, based on our previous intensive care experience, we decided to get an urgent thoracic CT considering tracheal rupture or tracheoesophageal fistule possible. In the thoracic CT of the patient, the image was consistent with tracheal-bronchial rupture. Therefore, it was decided to follow-up the chest tubes, to delay the enteral feeding for some more time and to start the appropriate antibiotics treatment. A few days later, the patient was extubated, the chest tubes were removed, and enteral feeding was started. During further follow-up, no additional problems were observed and the patient was discharged on the 31st day upon approval from the related departments.

Conclusions: In polytrauma patients especially with thoracic trauma, we are of the opinion that thoracic CT should be obtained prior to enteral feeding considering that tracheoesophageal fistule may develop.

Keywords: Polytrauma, Tracheal rupture
NON-OPERATIVE MANAGEMENT OF COMPLICATIONS FOLLOWING DAMAGE CONTROL SURGERY IN PATIENTS WITH MASSIVE LIVER INJURY

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Introduction: Massive liver injury carries high morbidity and mortality. Although perihepatic packing improved survival, this leaves parenchymal damage untreated, often resulting in postoperative complications and subsequent rise in mortality. We report two cases of non-operative treatment for complications after damage control surgery in patients with massive liver injury.

Case: A 40-year-old male machinery mechanic was struck by metal shaft on abdomen during operation in an accident. CT scan revealed multiple, large laceration defect in right of liver with active bleeding. After transarterial embolization, damage control surgery was performed due to his hemodynamic instability. In the recovery period, large amount of bile was drained into drainage catheter and biliary leakage was identified in endoscopic retrograde cholangiopancreatography (ERCP). Seven days after internal stenting and nasobiliary drainage, there was no more bile leakage in follow-up cholangiography via nasobiliary catheter. The patient was recovered uneventfully and discharged from hospital 48 days after the operation. A 48-year-old man was referred to our hospital after a blunt abdominal injury from a motor vehicle crash. CT scan showed large laceration and hematoma in right lobe of liver with active bleeding. Due to hemodynamic instability, damage control surgery was performed, followed by transarterial embolization. After operation, turbid fluid was drained from drainage catheter continuously. Follow-up CT scan showed multiple large encapsulated fluid collections in subhepatic space. After several times of percutaneous drainage, the patient discharged without complications 72 days after operation.

Conclusions: Postoperative complications following damage control surgery in massive liver injury could be managed non-operative strategies.

Keywords: Non-operative, Complication, Damage control surgery, Liver injury
SUBCUTANEOUS OEDEMA DUE TO CENTRAL VENOUS CATHETER DISLOCATION

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Introduction: Central venous catheterization provides a prompt and reliable access to the venous system. It is particularly useful for infusions in patients in shock with peripheral venous collapse, for the continuous monitoring of central venous pressure, and in patients requiring long-term intravenous infusions.

Case: The patient, who had been followed up for a year by the Neurology Department, was diagnosed with respiratory insufficiency. At that time, a subclavian catheter was placed in the patient. Following the development of acidosis and hypercapnia, the patient was intubated. On the 14th day, tracheostomy was performed. On the 28th day, diffuse pitting oedema was observed on the upper part of the patient’s body. As a result, catheter dislocation was suspected and when a blood aspiration test was performed, it was observed that blood was coming from the catheter. In the chest graph, it was seen that the tip of the catheter had slightly moved upward, and no symptoms related to pneumothorax were observed. As the subclavian catheter has 3 pores, it was considered that proximal 1 or 2 pores were in the subcutaneous region, and the distal pore was still in the vein; and therefore, the catheter was removed. In the following 2 days, the oedema of the patient gradually decreased and on the 3rd day, the patient completely returned to normal.

Conclusions: We believe that it would be appropriate to remove the catheter considering the possibility of catheter dislocation if oedema develops where the catheter is placed in the patient.

Keywords: Catheterization, Complication, Oedema
PREVENTION OF CIRCULATORY INSTABILITY DURING INDUCTION OF BLOOD PURIFICATION FOR A HYPER-AMMONEMIA CHILDREN: A CASE REPORT

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Introduction: Circulatory blood volume is small in a premature child, so that circulatory instability frequently occurs during induction of blood purification and needs catecholamine supports. Therefore, supportive maneuvers to prevent the instability have been required.

Methods: We applied several maneuvers such as 1. Mixture of O type (+) red cell concentrate (RCC) and fresh frozen plasma (FFP) 2 to 1 ratio was used for in-circuit solution to increase the viscosity (Hb 13 g/dl) and the volume (100 ml). 2. Internal circuit pressure was elevated just before initiation of blood purification by means of adding small amount of the mixture. 3. The speed of a roller pump was increased very slowly to prevent circulatory instability during induction, and the flow rate was increased 30～40 ml/min to prevent intra-circuit coagulation. 4. The blood purification device is manufactured to push the mixture solution into his body, when the internal circuit pressure becomes positive. A blood drawing pump and a purification pump were simultaneously started to produce positive pressure in the circuit.

Case: A case of 2 days old boy (2592 g) received blood purification therapy due to hyper-ammonemia by suspicious ornitine transcarbamylase deficiency. Using the upper procedures, he received blood purification without circulatory instability and approximately half dose of catecholamine.

Conclusions: It is very important to know the small circulatory volume and to secure stable circulatory supports to accomplish blood purification in premature children.

Keywords: Blood purification, Circulatory blood volume
MANAGEMENT OF FAT EMBOLISM SYNDROME CASE IN INTENSIVE CARE UNIT EMERGENCY DEPARTMENT IN DEVELOPING COUNTRY

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Introduction: Fat embolism syndrome is a life-threatening condition that can develop after orthopedic injury and surgery. Fat embolism may be defined as a blockage of blood vessels by intravascular fat globules ranging from 10–40 μm in diameter. Histological fat deposition in the pulmonary capillaries occurs in all patients who have long bone and pelvic fractures, although only 1–2% of these patients develop a respiratory and/or neurological syndrome known as the fat embolism syndrome. Rarely, fat embolism will cause a cardiovascular syndrome known as the fulminant fat embolism syndrome.

Case: This syndrome developed in a 17-year-old man after a traumatic femoral fracture and antebrachii fracture that was admitted from rural hospital. At that hospital this patient was managed for the fracture stabilization surgery. But at the that time, the patient became worst. The Oxygen saturation was 88% after anesthetized, and the surgery was canceled. Extubation was done and the patient referred to the ward. The patient was referred to the centre of referral hospital in general hospital Dr Soetomo hospital after 12 hours delay in the rural hospital. After admitted to the emergency room, the patient was intubated and stabilized the fracture in the operating room. Ptechieae in subconjunctiva, axillary, deltoid appeared clearly. Snow storm appearance from x-ray supporting the diagnosis of Fat Embolism Syndrome. After the surgery, the patient ventilated with ventilator for 4 days in intensive care unit. Extubation was done on the 5th day in ICU and referred to the ward after stable.

Conclusions: In conclusion, we advocate that early stabilization of the long bone fracture may avoid the fat embolism syndrome. Early suspicious of Fat Embolism Syndrome by the pulse oxymetry support to do early management for the airway, breathing, circulation, brain and nutrition for the best outcome.

Keywords: Fat embolism syndrome, Long bone fracture, Snow storm appearance
OBSERVATIONAL STUDY: HIGH FLOW NASAL CANNULA OXYGEN THERAPY FOR THE FIRST IMPORTED CASE WITH MIDDLE EAST RESPIRATORY SYNDROME IN CHINA

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Introduction: To report the application of high flow nasal cannula (HFNC) oxygen therapy in a Middle East Respiratory Syndrome (MERS) patient. To discuss the efficacy of this therapy in the MERS patient.

Case: Observational methodology was employed to report and appraise the application of HFNC in Chinas first imported case with MERS, complicated by acute respiratory distress syndrome (ARDS). Patient showed good tolerance and high compliance to HFNC. After commencing HFNC therapy, the respiratory function and oxygenation were improved, and the ARDS resolved. No nosocomial infection.

Conclusions: HFNC could significantly improve the respiratory function in patients with MERS. Additionally, there may be efficacy for those cases complicated with ARDS, where HFNC might help to prevent nosocomial infection. Further controlled studies are warranted.

Keywords: Middle east respiratory syndrome (MERS), ARDS, High-flow nasal cannula (HFNC)
FAMILY STRESS AND ATTITUDES TOWARD THE WITHDRAWAL OF LIFE-SUSTAINING TREATMENT IN NEUROLOGIC ICU

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Background/Purpose: Family members with patients in neurologic intensive care unit (ICU) are under stress. In Korean culture, talking about death and the withdrawal of life-sustaining treatment are stigma. The purpose of this study was to examine the relationship between attitudes toward the withdrawal of life-sustaining treatment and family stress among family members with patients in neurologic intensive care unit (ICU).

Methods: A total of 68 family members with patients in neurologic ICU at a hospital in Busan, Korea. Self-reported questionnaire including socio-demographic characteristics, attitudes toward the withdrawal of life-sustaining treatment, and family stress were used to collect the data. Data were analyzed with descriptive statistics and Pearson’s correlation coefficients.

Results: Of subjects, 56% were men, 71% were children of the patients, and 62% had more than college education. About 84% of family members agreed that the withdrawal of life-sustaining treatment should be explained to family members. The mean of attitudes toward the withdrawal of life-sustaining treatment was 3.27 out of 5 points, while the mean of level of family stress was 2.76 out of 4 points. There was a significant relationship between attitudes toward the withdrawal of life-sustaining treatment and family stress (r=.284, p=.019).

Conclusions: Majority wanted to talk about the withdrawal of life-sustaining treatment for their loved one. However, decision-making in the withdrawal of life-sustaining treatment for their loved one could make more stress in family members. Advance directives could help reducing the level of family stress about decision-making.

Keywords: Family stress, Life-sustaining treatment, Neurologic intensive care unit
NEW-ONSET ATRIAL FIBRILLATION IN A SEPTIC POST-OPERATIVE CRITICALLY PATIENT

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Introduction: New-onset atrial fibrillation (AF) is commonly seen in critically ill patient but management of septic post-operative patient with newly diagnosed AF in intensive care unit (ICU) can be challenging.

Case: A 73 year-old-lady admitted to hospital for acute abdominal with diagnosis of septic peritonitis. 8 hours after small bowel resection, she developed new-onset AF with compromise hemodynamic in ICU. The initial treatment included loading dose of 300mg amiodarone infusion but it was stopped as severe hypotension developed. Subsequently, 3 shocks of synchronize biphasic cardioversion at 50 J, 100J and 150J were delivered. Although blood pressure restored, the electrical therapy failed to abort the fast AF. The amiodarone was resumed and hypotension developed again with dopamine and nor-adrenaline infusion set up. Low serum potassium of 3.4mmol/L was detected and corrected by intravenous KCL supplement. 500ml modified gelatin was administered after echocardiogram was done showing narrow collapsible IVC. Amiodarone maintenance drip was set up. Daily Albumin 30g IV was added and antibiotics was changed from amoxicillin/clavulanate to piperacillin/tazobactam. Thrombo-emoblic prophylaxis, enoxaprin, was prescribed in day 3. The AF was finally controlled and converted into sinus rhythm in day 4 ICU with amiodarone infusion wean off in Day 5.

Conclusions: This case report illustrates using only electrical cardioversion and anti-arrhythmic without the correction of the underlying reversible pathological conditions such as operation stress, inflammation, fluid shift and electrolyte imbalance would not be effective in managing the haemodynamic distress of the septic post-operative critically ill patients with AF.

Keywords: New-onset atrial fibrillation
MENTAL CARE FOR FAMILIES OF SPINAL CORD INJURY PATIENTS BY ER/ICU NURSES

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Background/Purpose: This article reports on an investigation of the mental care provided to families of spinal cord injury patients by ER/ICU nurses.

Methods: Semi-structured interviews were conducted with three nurses who had over three years' of experience working in an ER/ICU, and the interview data was analyzed qualitatively.

Results: Family mental assessment can be classified into the four chronological stages a family goes through, beginning with the occurrence of the patient's injury. The interview data revealed that nurses provide mental care based on their ongoing assessment of the family's psychological processes. Special skills are required to understand the family's mental state and provide appropriate mental care.

Conclusions: When providing mental care for families of spinal cord injury patients, ER/ICU nurses make it a priority to build a trust relationship with the family and provide appropriate information so that the family can support the patient. They also ascertain the mental state of the family and work to maintain the relationship between the family and the patient while helping the family accept and come to terms with the patient's disorder.

Keywords: Spinal cord injury patient, ER/ICU, Family care
NURSING SATISFACTION AND CLINICAL OUTCOMES BEFORE AND AFTER IMPLEMENTATION OF FASTHUG AND BANDAIDS CARE PROCESSES IN MEDICAL INTENSIVE CARE UNIT

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Background/Purpose: FASTHUG and BANDAIDS are the composite care processes for all critically patients, which could improve ICU care. We have implied these care processes for evaluate the satisfactory of nurses and theirs efficacy on clinical outcomes. Objectives: To evaluate nursing satisfaction and ICU clinical outcomes 12 months after implement of FASTHUG and BANDAIDS.

Methods: We have implied FASTHUG and BANDAIDS care processes to our routine care since January 2012. Nurse satisfactory scores, out of five, were evaluated before and 12 months after implementation in 4 aspects: the confidence of holistic care, the satisfactory to nursing outcome, the reduction of confusion on sophisticated care and the improvement of patient care competency. Clinical outcomes, included mortality rate, ICU length of stay, costs of ICU care and hospital care, were collected before and 12 months after implementation. Paired T-test and independent T-test was respectively used for statistical analysis. P-value < 0.05 was statistically significant.

Results: During 12 months period, 40 critical care nurses were recruited to this satisfactory evaluation and 1,082 critically ill patients were collected for clinical outcomes. There was statistically significant improvement in all aspects of nurses satisfactory (table1). However, there was no statistically significant impact on patient clinical outcomes (table2).

Conclusions: Although FASTHUG and BANDAIDS composite routine ICU care did not impact of ICU clinical outcomes, these care processes significantly increased critical care nurse satisfactory, improved confidence in patient care and also reduced the confusion of sophisticated care in medical critically ill patients.

Keywords: FASTHUG and BANDAIDS, Nursing satisfaction, Clinical outcomes
RELIABILITY AND VALIDITY OF THE JAPANESE VERSION OF CRITICAL-CARE PAIN OBSERVATION TOOL

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Background/Purpose: Patients in ICU experience various pains. Pain control is important because pain adversely affects the patient’s wellbeing. Since verbal communication is difficult for most of the patients due to artificial airway and sustained sedation, Critical-Care Pain Observation Tool (CPOT) was developed in English and translated into Japanese. Although English version was verified its reliability and validity, Japanese version needs to be assessed its credibility owing to differences in nuance and cultural background between English and Japanese languages. Therefore, the interrater reliability and convergence validity of the Japanese version (CPOT-J) was evaluated.

Methods: 25 cardiovascular surgery patients were assessed their pain in the ICU using CPOT-J. The interrater reliability was evaluated by comparing the researcher and 16 clinical nurses with ≥1 year of ICU experience. Convergent validity was determined by comparing with Numeric Rating Scale (NRS) after the patients extubation. The study was approved by Nagoya University Graduate School of Medicine Bioethics Committee and University of Yamanashi Faculty of Medicine Ethics Committee.

Results: Intraclass correlation coefficient (ICC) was 0.949 (p<0.000). ICCs for subscales of the CPOT-J were as follows: 0.885 (p<0.000) for Facial Expression, 0.546 (p<0.000) for Body Movements, 0.757 (p<0.000) for Muscle Tension, and 0.878 (p<0.000) for Compliance with the Ventilation or Vocalization. ICC for intubated patients was 0.962 (p<0.000), while ICC for extubated patients was 0.925 (p<0.000). Moderate correlation (r=0.652, p<0.001) was found between CPOT-J score and NRS.

Conclusions: The CPOT-J may be useful tool to measure the pain of patients in ICU with acceptable reliability and validity.

Keywords: Critically ill patients, CPOT, Pain assessment, Japanese
DIRECT CRITICAL CARE NURSING

Poster Presentation

INTRACRANIAL VASOSPASM ASSOCIATED WITH ACUTE SPONTANEOUS SPINAL SUBDURAL HEMATOMA

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Introduction: Acute spontaneous spinal subdural hematoma (SDH) is a very rare disease. However, it often results serious complications hence appropriate therapeutic approaches as well as fast diagnosis are warranted. Here, we report a rare case of the headache patient with intracranial vasospasm (ICVS) who was presented with acute spontaneous SDH.

Case: A 41-year-old woman was admitted to our hospital with a complaint of severe headache. She had no medical disease. Before visiting our hospital, multiple ICVS was noted in the brain CT angiogram of other hospital. After 1 day, she had a complaint of neck and back pain. Neurological examination showed marked neck stiffness. Brain CT show marked brain swelling with near total obliteration of whole subarachnoid space. In conventional cerebral angiography, there was multiple vasospasm. At the admission day 3, she presented both legs weakness (MRC I) and urinary incontinence. Also, she had anesthesia below the T6 level. The spine MRI showed C7-T6 spinal cord compression due to hyperacute stage subdural hematoma.

Conclusions: In our case, the patient did not have any risk factors of the hemorrhage, and complained of severe headache in the early stage; in the imaging, no hemorrhage (e.g., SAH) was shown while vasospasms were clearly established. It has been suggested that emergency surgical decompression is critical for acute spinal subdural hematoma to determine prognosis. Therefore, it is important to note that there is a possibility of the acute spontaneous spinal SDH in patients with headache who have ICVS despite no intracranial hemorrhage in the brain imaging examinations.

Keywords: Spinal subdural hematoma, Subarachnoid hemorrhage, Intracranial vasospasm
DECOMPRESSIVE CRANIECTOMY FOR NEUROLOGICAL EMERGENCIES: A SYSTEMATIC REVIEW

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Background/Purpose: Decompressive craniectomy has been used as a lifesaving procedure for many neurological emergencies, including traumatic brain injury, ischaemic stroke, subarachnoid haemorrhage, cerebrovenous thrombosis, severe intracranial infection, inflammatory demyelination and encephalopathy. However, the evidence to support using this procedure in many of these situations is limited. The aim of this review was to summarise the indications, benefits and complications of the procedure.

Methods: A literature search was performed in the MEDLINE database (1966-June 2012). The following keywords were used: hemicraniectomy, decompressive craniectomy, or decompression and craniectomy together with stroke, ischaemia, middle cerebral infarct, traumatic brain injury, head injury, subarachnoid haemorrhage, infection, subdural empyema, sinus thrombosis, cerebrovenous thrombosis, encephalitis, or meningitis

Results: Over 130 studies reporting on use of decompressive craniectomy for various neurological emergencies were identified. In the context of stroke, TBI and subarachnoid haemorrhage randomised controlled trials and cohort studies were analysed. This level of evidence was not available for decompressive craniectomy for the less common indications such as cerebral venous thrombosis and intracranial infection therefore case reports were included in the analysis for these conditions.

Conclusions: Whilst there is conclusive evidence that decompressive craniectomy can be life saving there is currently insufficient evidence that outcome is improved. There are substantial differences in the methodology of outcome assessment and this makes interpretation and pooling of results impossible.

Keywords: Craniectomy, Evidence, Neurology
SIMULATION-BASED EDUCATION OF CRITICAL-CARE NURSING IN SOUTH KOREA: A REVIEW OF LITERATURE FOR THE CURRENT STATE OF THE SCIENCE

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Background/Purpose: This study was developed to describe the current state of simulation-based education of critical care in South Korea finding gaps in knowledge and thus, in the future, simulation-based nursing education of critical care can be strengthened in South Korea.

Methods: Two major Korean databases (Korean studies Information Service System and Research and Information Sharing Service) and two international databases (Pubmed and CINHAL) were used to search the literature. The search was limited to 10 years old of articles, human subjects, and nursing journals. Two search key words, critical care and nursing simulation, were used to find appropriate research articles.

Results: 10 related articles from the Korean search engines and 20 articles from the international database were selected to analyze. The most common illnesses/problems of scenarios used to practice in the critical-care-based simulation, South Korea were respiratory disease, acute coronary syndrome, cardiopulmonary resuscitation, cerebrovascular accident, and mechanical ventilation. The two most frequently used outcome variables in South Korea were Self-efficacy and clinical performance. The articles found from the two international databases revealed that western research articles have included more various illnesses/problems of scenarios. Also, it showed that the phase of critical-care simulation in western countries is shifting to theme of multidisciplinary critical-care from traditional research of effectiveness of critical-care-based simulation in singular discipline.

Conclusions: Compared to western countries, the current state of Korean nursing research in critical-care-based simulation is limited: more varied illnesses/problems of scenarios about critical-care nursing and research based upon multidisciplinary simulation in critical care should now be initiated.

Keywords: Critical-care nursing, Simulation, Interdisciplinary
RISK FACTORS OF UNPLANNED READMISSION TO INTENSIVE CARE UNIT

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Background/Purpose: The purpose of this study is to investigate the characteristics of patients of unplanned readmission that could have huge impacts on treatment results and thus threaten the patient safety, and identify the risk factors of readmission, ultimately providing basic data for specific and objective ICU discharge criteria to determine safe discharge and making a contribution to nursing intervention plans for high risk patients of unplanned readmission.

Methods: We retrospectively reviewed the electronic medical records which included the data of 844 who had discharged from ICUs in a university hospital in Incheon from June 2014 to December 2014.

Results: The unplanned readmission rate was 6.4% (n=54). The ten variables were significantly different between the unplanned readmission and no readmission groups: major symptoms at the 1st admission, scores on the patient severity classification tool at the 1st admission, APACHE II score at the 1st admission, number of days when a ventilator was used during the 1st ICU, scores on the patient severity classification tool at the 1st discharge, APACHE II score at the first discharge, GCS scores at the 1st discharge, amount of oxygen supply at the 1st discharge, sputum secretion method, and length of stay at 1st ICU. Scores on the patient severity classification tool at the 1st admission, APACHE II score at the first discharge, number of days when a ventilator was used during the 1st ICU were the significant predictors of unplanned ICU readmission.

Conclusions: The findings indicate that the characteristics of patients at the time of discharge will have significant effects on unplanned readmission to ICU and raise an urgent need to do specific and accurate patient evaluations at the time of discharge and prepare a set of objective discharge criteria.

Keywords: Intensive care unit, Readmission
OUTCOME OF THE IMPLEMENTATION OF CHLORHEXIDINE GLUCONATE (CHG) TRANSPARENT DRESSING ON THE OCCURRENCE AND INCIDENCE OF CENTRAL LINE ASSOCIATED BLOODSTREAM INFECTION (CLABSI) IN MEDICAL CRITICALLY ILL

Supattra Uppanisakorn, Chonticha Pochanakij, Jaruwan Boonyarat, Rungsun Bhurayanontachai

Medical Intensive Care Unit, Songklanagarind Hospital, Thailand

Background/Purpose: CLABSI is one of the common ICU-acquired infections, which may impair ICU outcome. CLABSI prevention bundles were recommended. CHG transparent dressing may attenuate the occurrence of CLABSI. Objective: To evaluate the outcome of CHG transparent dressing on CLABSI occurrence and incidence in medical ICU patients.

Methods: All critically ill patients, who were admitted to medical ICU during January 2014 to December 2014, were recruited. CLABSI bundle was applied. Those patients, who expected to retain catheter for longer than 72 hours with multi-drug resistance bacterial infection or neutropenia or immunocompromised and no bleeding at the insertion site, were allocated for CHG group. CLABSI was identified according to standard definition. The occurrence of CLABSI was compared by Pearson Chi-square test. Incidence of CLABSI/1,000 catheter day was compared by Man Whitney U test. The p-value <0.05 was statistically significant.

Results: 380 medical critically ill patients were recruited. Of those, 453 central venous catheterization was recorded. Jugular vein is the commonest site of insertion (72.63%). Almost 75% (336/453) of all catheterisation obtained CHG dressing. There was no statistically difference of the median central venous catheter day between the groups (3(0.64)d vs 3(0.31)d, p-value=NS). There was no statistically difference of CLABSI occurrence between CHG and non-CHG group (4/336 (1.19%) vs 2/117(1.70%), p-value=NS). In addition, the incidence of CLABSI/1,000 catheter day did not statistically difference (1.88 vs 3.03, p-value =NS).

Conclusions: The CHG transparent dressing may not reduce the occurrence and incidence of CLABSI in medical critically ill patients.

Keywords: Central line associated bloodstream infection, Chlorhexidine gluconate
NEEDS OF FAMILY MEMBERS OF CRITICALLY ILL PATIENTS-A CNS-FACE STUDY

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¹Department of Nursing, Teikyo University Chiba Medical Center, Japan, ²Emergency & Intensive Care Center, Teikyo University Chiba Medical Center, Japan

Background/Purpose: To determine influences of admission route to ICU on needs and stress of family members of ICU patients. SUBJECTS of this study are Family members of ICU patients who admitted from July 1, 2014 to September 30, 2014 (three months) and consented to our study.

Methods: We assessed needs and copings of family members on the admission day by CNS-FACE (Coping and Needs Scale for Family Assessment in Critical and Emergency care setting) developed by Yamase et al. and analyzed influences of difference of admission route. CNS-FACE is developed in 2002 and consists of 46 items of observation which are divided in 6 categories of NEEDS and two categories of COPING and assessed in 4 ranks.

Results: 1) Forty-two persons are involved. As for admission route, Twenty-two are from ER or outpatient clinic of the hospital, eleven from OR after elective surgery, and nine are from general wards after sudden worsening of vital signs. 2) Family members of ER/outpatient clinic need information most and members of suddenly worsened patients and postoperative patients need frequent visits most. 3) Kruskal-Wallis test revealed need of quality of treatment is significantly higher than other needs and it is most distinctive in suddenly worsening group according to Scheffe’s multiple comparison test analyzed. 4) No remarkable difference is observed with regard to copings.

Conclusions: Family members of ICU patients need information, frequent visits, and best quality of treatment in general and needs are different depending on routes of administration.

Keywords: Needs of family, Coping
MASSIVE PNEUMOPERITONEUM FOLLOWING CARDIOPULMONARY RESUSCITATION- A CASE REPORT

Ki Hoon Kim

Inje University Haeundae Paik Hospital, Republic of Korea

Introduction: The term pneumoperitoneum is used to describe the presence of free gas within the peritoneal cavity. The m/c source is from visceral perforation. Pneumoperitoneum following CPR had been described as a rare complication. Pneumoperitoneum may develop following CPR is most commonly from a ruptured viscus, and intrathoracic air tracking into the abdominal cavity via the diaphragm as a result of bag-valve-mask ventilation, external chest compression or improper intubation. We reported an unusual case of pneumoperitoneum following CPR in which the specific cause was not definitely established.

Case: An 81-year-old man who was known to have major depressive disorder and polyneuropathy was brought to the emergency department after drug intoxication. Upon arrival at the ED, the patients mentality was stupor and initial vital signs showed an unstable. Promptly intubation was performed. Initial CXR was non-specific (Fig1). Brain CT showed suspicious lacunar infarction or other in the right thalamus, and mentality continued drowsy state. Hence, MRI study was performed. During the examination of MRI, patients showed irritability, and then mentality changed from drowsy to comatous. During the delivery to ER, CPR was performed. Return of spontaneous circulation developed after a total of 15 minutes of CPR. At follow up radiologic study, subcutaneous emphysema, pneumomediastinum and pneumoperitoneum were showed (Fig. 2). The patient was taken to the operation room for laparotomy. On exploration of the abdomen, cause of pneumoperitoneum was not found. The patient showed a significant and prompt recovery.

Conclusions: Prudent decision for surgery should be made.

Keywords: Pneumoperitoneum, Visceral perforation, Cardiopulmonary resuscitation
THE USE OF IV NORMAL SALINE 0.9% (NS) INSTEAD OF IV HEPARINIZED SALINE 10 UNITS/ML (HEPS) FOR PERIPHERAL INTRAVENOUS (IV) CANNULAE IN THE PAEDIATRIC PATIENTS IN KKH

Ang Su Ling Linda, Lim Shu Jing Rosanna, Cher Loh Hoon

KK Women’s and Children’s Hospital, Singapore

Background/Purpose: NS as the flush solution to maintain patency of intravenous (IV) cannulas in adult patient population has been well established in many studies. Currently, paediatrics patients are using HepS to maintain patency of IV cannulas for those without continuous fluid infusion. With the risks associated with heparin administration, a study was performed with the aim of changing current practice to ensure safety for the paediatric population.

Methods: Data from several piloted pediatric wards of different subspecialties were collected in two phases over 3 consecutive months in 2012 via an observational study. A total of 320 IV cannulas were monitored for its patency with HepS used that was in accordance with current practice. A total of 379 IV cannulas were monitored when NS was used as a flush solution ending with a positive pressure.

Results: Results revealed that there were minimal blockage and adverse effects from using NS as a flushing agent. This also implied that IV cannulas that were solely flushed with NS were able to last longer thus optimizing patient’s treatment outcome and reducing undesirable stress as well as undue pain. Based on the favourable findings of the outcome study suggesting that IV NS flush is a safe alternative to IV HepS, CMB’s approval was sought for the change of practice and this has been approved.

Conclusions: IV NS flush is a safe alternative in replacing IV HepS for pediatric patients with peripheral IV cannulas. With this change in nursing practice, patient’s safety and hospitalization stay is further enhanced.

Keywords: IV normal saline 0.9%, IV Heparinized saline, Peripheral IV cannula
FAILURE MODE EFFECT ANALYSIS (FMEA) ON PAEDIATRIC INTRAVENOUS (IV) CANNULAE CARE IN KKH

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KK Women’s and Children Hospital, Singapore

Background/Purpose: The aim of this project is to prevent and or minimize adverse events associated with the management of peripheral intravenous cannula by ensuring a safe and effective practice for our pediatric patients. A taskforce was formed to analyses the security and plastering methods of the intravenous cannulae which might potentially compromise patient safety.

Methods: FMEA is a systematic, proactive method designed to promote patient safety by mapping out the process of care, follows by identifying potential failures that may occur in this process, in order to identify the parts of the process that are most in need of change. Using the FMEA model, the group analysed the entire process to secure a paediatric IV cannulae. Potential failure modes that might impact on patient safety in the various sub-processes were identified as requiring improvements. The group then listed the appropriate safety measures that was necessary to prevent potential accidentally sniping off the IV cannulae.

Results: Post implementation of the safety measures using different types of adhesive dressing without a criss cross tape over the hub of the cannulae had shown significant reduction in risk priority number scores which indicate the success of FMEA in minimizing patients’ harm. Data from 2 piloted pediatric wards were collected for 2 months in 2014 via an observational study. A total of 130 samples were collected using different types of adhesive dressing shown favorable findings of the outcome. The risks of mortality and morbidity of patients will be minimized. It also eliminates any potential fatal errors from occurring.

Conclusions: With the development of safety guidelines on the use of new adhesive dressing without a criss cross tape over the hub of the cannulae, we have achieved our goal of eliminating the potential risks that can result in fatal error in this vulnerable group of patients. Through the use of FMEA, we hope to reduce the risk and improve patient safety.

Keywords: IV cannulae, Paediatric
SAFE DRUG MANAGEMENT INTENSIVE CARE UNIT

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Istanbul University of Faculty Health Sciences, Turkey

Background/Purpose: To understand the safe drug management in intensive care unit (ICU).

Methods: It has been determined that errors are made in drug prescription, supply and drug applications in the ICU, and these errors threaten the patient health. Illegibility of the doctors requests, collective and unsafe transportation of the drugs to the services, irregularities in recording the drug applications, ineffective monitoring of the drug applications, indetermination of high-risk drugs, nonobservation of drug-drug and drug-nutrient interactions and ignorance of the possibilities for mistaking drugs with the same names are among the drug application errors. Besides, errors also occur depending on the excessive work load, which is caused by the haste the nurses quit their jobs in, the deficit in the number of nurses and the instability of the nurse-patient ratio, and the insufficiencies resulting from the procedures and communication.

Results: The first thing to do for eliminating the problems is the formation of all the processes and procedures related to drug management. Sufficient manpower, a good work environment and the culture of patient safety must be provided, and national and international suggestions must be taken into account for drug management. Error reporting system must be created to put forth the present situation. Moreover, drugs must be prescribed on computer by the doctors, good in-house communication must be provided and clinical pharmacists must be employed in the units.

Conclusions: One of the keys of all the improvement efforts is training. Great importance must be given to patient safety and drug safety in trainings.

Keywords: Drug safety, Medication errors
LONG TERM SURVIVAL FOLLOWING DECOMPRESSIVE CRANIECTOMY FOR SEVERE TRAUMATIC BRAIN INJURY: THE DISABILITY PARADOX

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Background/Purpose: The aim of this study was to assess the long-term outcome and quality of life of patients who have survived with severe disability following a decompressive craniectomy for severe traumatic brain injury.

Methods: This study assessed outcome beyond three years amongst a cohort of thirty nine patients who had previously been adjudged either severely disabled or in vegetative state, 18 months after decompressive craniectomy for TBI. The assessments performed were; the extended Glasgow Outcome Scale (GOSE), the Barthel Index (BI), the Zarit Caregiver Burden Interview and the short form 36. The issue of retrospective consent for surgery was also assessed.

Results: Of the thirty nine patients, seven had died and twenty patients or their next of kin consented to participate. Of those twenty patients, the five patients who were in vegetative state at 18 months remained so beyond three years and the remaining 15 patients remained severely disabled after a median follow-up period of 5 years. The patients SF-36 physical score were inversely correlated with the severity of TBI. The mental SF-36 scores of the patients were, however, reasonably high. The majority of patients and their next of kin felt that they would have provided retrospective consent for surgical decompression even if they had known their eventual outcome.

Conclusions: Substantial physical recovery beyond 18-month after decompressive craniectomy for severe TBI was not observed however, many patients appeared to have recalibrated their expectations regarding what they felt to be an acceptable quality of life.

Keywords: Neurotrauma, Rehabilitation
EFFECTS OF HEAD-UP TILT POSITIONING ON CEREBRAL HEMODYNAMICS, EVALUATED BY NEAR INFRA-RED TIME-RESOLVED SPECTROSCOPY

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Background/Purpose: Head-up tilt positioning (HUTP) is applied to reduce intra-cranial pressure. But there was not any adequate objective parameter to detect cerebral hemodynamics (CH).

Methods: CH was evaluated in 10 healthy volunteers by a near infra-red time-resolved spectroscopy (NIR-TRS). HUTP (degree) was applied repeatedly as supine position (0 degree) to 15 to 0 to 30 to 0 to 45 to 0 to 60 to 0 for 5 minutes each. Intra-cerebral tissue oxygen saturation (StO₂, %), total hemoglobin (tHb, mmol/L), oxy-hemoglobin (O₂Hb, mmol/L) and deoxy-hemoglobin (HHb, mmol/L) were measured every 5 seconds on their right and left forehead. P values <0.05 was considered statistically significant.

Results: StO₂, O₂Hb and tHb were significantly decreased by HUTP at 30, 45 and 60 degree, compared to that at 0 degree, respectively (Figure). The tendency of the left side values was same.

Conclusions: The response of the NIR-TRS is extremely fast, so that the parameters changed by positioning, could be measured. Reduction of StO₂ related to the reduction of O₂Hb was not large and HHb did not significantly change, cerebral oxygenation might be maintained by their intact brain circulatory autoregulation. In the brain insulted patients, the autoregulation is lost. In these situations, brain monitoring by NIR-TRS might be more valuable.

Keywords: Near infra-red spectroscopy, Cerebral, Hemodynamics, Positioning, Nursing
SELF-DESCRIBED NURSING RESPONSES EXPERIENCED DURING CARE OF DYING PATIENTS AND THEIR FAMILIES: A PHENOMENOLOGICAL STUDY

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¹Lancaster General Hospital, United States, ²University of Maryland School of Nursing, United States

Background/Purpose: Critical care nurses caring for dying patients and their families experience complex feelings and stressors, which can be surprising and beyond individuals ability to interpret and internalize. Little is known about feelings and experiences of bedside nurses or how they are affected during end-of-life care. Study purpose was to understand lived experiences and feelings encountered by critical care nurses during end-of-life care.

Methods: A descriptive phenomenological study using a purposive sampling strategy recruited 19 critical care nurses with experience caring for dying patients and their families. Individual interviews were conducted, audio-recorded and transcribed verbatim. Each nurse was asked open-ended questions about their experience and responses when caring for dying patients and their families. Colaizzi’s method of data analysis was utilized to inductively determine themes, clusters and categories. Data saturation was achieved and methodological rigor was established.

Results: Main responses included personalizing the experience, sadness, ageism, anger, frustration, relief and stress. Factors contributing to the clinicians lived experience included prior experiences with death affecting how the experience was personalized and issues encountered in care delivery contributing to feelings of anger.

Conclusions: Study results have implications for practice, education and research. Critical care nurses may be unprepared for feelings and personal responses encountered when caring for dying patients and their families. Teaching and preparation for these feelings and responses encountered during care of dying patients and their families in nursing education and critical care orientation classes is essential. Future research should study optimal means to mentor, teach and prepare nurses to provide optimal end-of-life care.

Keywords: Phenomenological study, Personal context, Feelings
SELECTION OF AN INSTRUMENT TO EVALUATE THE ORGANIZATIONAL ENVIRONMENT OF NURSES WORKING IN INTENSIVE CARE: AN INTEGRATIVE REVIEW

Brett Abbenbroek, Christine Duffield, Doug Elliott
University of Technology, Australia

Background/Purpose: Internationally the demand for intensive care is increasing. Solely increasing bed capacity is not sustainable. Large capacity multi-specialty Intensive Care Units are emerging as the preferred organizational model with benefits resulting from optimizing operational synergies and economies of scale. The impact of this organizational transition on intensive care nurses is not well understood. The purpose of this review is to determine an appropriate survey instrument to evaluate the impact of organizational structures on the work environment of intensive care nurses.

Methods: Integrative literature review. Data Sources: CINAHL, PubMed, EMBASE and OVID Nursing databases searched for studies published between 2005 and 2013. An integrative review and quality assessment of the studies was undertaken to select nurse outcome measures associated with organizational structures across a range of acute and critical care settings. Congruence between nurse outcome measures and nurse survey instruments tested in the literature was assessed to select instruments for further psychometric evaluation.

Results: Thirty-one cross sectional quantitative studies, from fourteen countries, were reviewed. Twenty one nurse outcome measures associated with organizational factors were identified and a total of twenty five survey instruments used in the studies reviewed. Assessment of congruence and psychometric properties determined that a combination of two instruments is required to comprehensively assess the organizational environment of nurses working in intensive care units.

Conclusions: The environment of nurses working in intensive care is effectively evaluated with an instrument that combines the Practice Environment Scale-Nurse Work Index and Maslach’s Burnout Inventory.

Keywords: Nurse, Intensive care, Organization, Environment
THE PREVALENCE OF LOW BACK PAIN AND ITS ASSOCIATIONS IN NURSES WORKING IN INTENSIVE CARE UNITS

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Eskisehir Osmangazi University Medical School, Department of Physical Medicine and Rehabilitation, Turkey

Background/Purpose: Low back pain (LBP) is common symptom in nurses and its origin is multifactorial. The purpose of this study to search the prevalence of LBP, and its associations in intensive care nurses.

Methods: A self administered questionnaire included questions related to demographic and job characteristics, psychosocial job satisfaction (PSJS) and SF-36-Vitality for fatigue were applied. The LBP intensity lasting for at least 1 day during last 7 days was determined with Visual Analogue Scale in nurses working in intensive care units (ICUs) since at least 3 years.

Results: Sixty four intensive care nurses (mean age: 32.0±5.46 years) participated in this study. The prevalence of LBP lasting for at least 1 day during last 7 days was 76.6 % in nurses working in ICUs since at least 3 years. Pain intensity was correlated with working hours per week (p=.027) and patient transfer in room (p=.024). There were associations of pain intensity with working positions which are kneeling on one knee (OR=2.533 (.219-29.290)), both knee squatting (OR=2.056 (.182-23.162)), body rotation during standing (OR=.229 (.028-1.876)), trunk flexion during standing (OR=1.075(.991-1.167)) and trunk flexion and rotation during standing (OR=.265 (.033-2.147)). The pain intensity was also related to PSJS (OR=2.563 (.689-9.534)) and fatigue scores (OR=.683 (.205-2.263)).

Conclusions: These data indicate that intensive care nurses working conditions contribute to increment in low back pain. For these reasons, the attempts such as training in ergonomics, using lifting appliances and regulation of working hours should be cared to reduce low back pain in intensive care nurses.

Keywords: Low back pain, Intensive care nurses, Job characteristics, Working position, Psychosocial job satisfaction
FAILURE MODE EFFECT ANALYSIS (FMEA) PROJECT ON SAFE ADMINISTRATION OF EMERGENCY DRUGS (E-DRUGS) DURING RESUSCITATION

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¹Division of Nursing, Singapore, ²Children’s Intensive Care Unit, KK Women’s and Children’s Hospital, Singapore, ³Neonatal Intensive Care Unit, Singapore, ⁴Pharmacy, KK Women’s and Children’s Hospital, Singapore, ⁵Medical Informatics, Singhealth, Singapore

Background/Purpose: Safe administration of IV emergency drugs (E-drugs) during resuscitation was chosen as the FMEA project because of incidence of administration of 10 folds of intravenous adrenaline during resuscitation and the significant risk to the safety of the patients. Through the use of FMEA, we want to prevent the future occurrence of medication error during resuscitation.

Methods: A multidisciplinary team was formed to map out the entire process of IV administration of e-drugs during resuscitation, identify potential “Failure Mode” that can occur and then use the FMEA scoring system to look at probability of occurrence, severity of effects and detectability. Risk priority numbers were solicited from all members to identify failures most in need of attention. The results were collected by the number of incidences reported post resuscitation.

Results: Four main process steps and 20 sub-processes were outlined. RPN of more than 100 were found in the four main processes indicative that the prescription, retrieval of drugs, preparation and administration processes have the high potential for hazardous errors. Since the implementation of a safety measures, patient safety and quality care are evidenced by no reported incidence of medication error till date and the high risk failure modes were reduced by 62.5% for prescription, 60% for retrieval of drugs and 72.2% for preparation and administration processes.

Conclusions: FMEA is a useful safety improvement tool. It is a risk assessment methodology used to identify weaknesses in a complex hazardous process and generate corrective control measures to counteract these weaknesses before they result in adverse event.

Keywords: Failure Mode Effect Analysis, Emergency drugs, Resuscitation
<table>
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<tr>
<th>Process</th>
<th>Potential Failure Mode</th>
<th>Potential Causes</th>
<th>Potential Effect(s) of failure</th>
<th>Severity</th>
<th>Probability</th>
<th>Detection</th>
<th>Aims</th>
<th>Actions to Reduce Failure Mode</th>
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<th>POST IMPLEMENTATION in RED</th>
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**Pediatric Code Sheet**

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**DRUG**

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<th>DOSE</th>
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<th>CALCULATED AMOUNT</th>
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<tr>
<td>Nourishment</td>
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**Notes**

- Minimum dose: 100 mg (5 ml)
- Maximum dose: 500 mg (10 ml)
- Administer every 6 hours
- Monitor for adverse reactions
- Watch for signs of infection

**Distribution**

- Dosage for children:
  - 0-2 kg: 0.5 ml/kg
  - 2-10 kg: 1 ml/kg
  - 10-20 kg: 1.5 ml/kg

- DOSE = CALCULATED DOSE

**Form Code**

- System prints item banned on 10/30/11
- System prints item banned on 11/30/11
- System prints item banned on 12/30/11

**Poster Presentation**

12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS
CARDIOGENIC OSCILLATION AND VENTILATOR AUTOTRIGGERING IN A 22 YEAR-OLD WITH MALIGNANT BRAIN EDEMA: IMPLICATIONS FOR ORGAN RECOVERY AND TRANSPLANTATION

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Introduction: Ventilator autotriggering occurs in brain-death from interaction between a hyperdynamic cardiovascular state and compliant lung tissue causing cyclic gas movement within the patient-ventilator system. Cardiogenic autotriggering may go unrecognized, delay brain death testing, prolonging the ICU experience for families and restrict donor organ availability. This may confuse families, experienced critical care clinicians and neurologists regarding timing of brain death testing.

Case: A 22 year-old patient was admitted to a medical ICU with acute liver injury and decreased level of consciousness. He was intubated with initiation of controlled ventilation experienced refractory seizures and marked elevation in intracranial pressure. High-dose pentobarbital achieved seizure control, EEG burst suppression and short-term ICP reduction. Signs of terminal brain herniation were noted on ICU day 3 including arterialization of the ICP waveform, hyperdynamic cardiovascular state and areflexic neurological examination. Brain death protocol was delayed due to patient overbreathing ventilator set rate. Ventilator waveform analysis revealed flow waveform oscillations exactly matching heart rate and exceeding trigger threshold. Waveform deflections indicating intrinsic respiratory drive were absent. Pressure triggering with threshold at -2 cm H20 was initiated, eliminating autotriggering. Brain death testing proceeded and the patient was pronounced dead.

Conclusions: Hyperdynamic cardiovascular state and high stroke volume following brainstem herniation displaces compliant lung tissue causing gas movement within the patient-ventilator system in phase with the cardiac cycle. Cyclic gas displacement may exceed ventilator trigger sensitivities, initiating ventilator breaths beyond the set rate. This may be misidentified as intrinsic respiratory drive causing delay in brain death determination and loss of transplantable organs.

Keywords: Cardiogenic oscillation, Ventilator triggering
STRESSFUL EXPERIENCES IN THE INTENSIVE CARE UNIT OF PATIENTS PUT ON MECHANICAL VENTILATORS FOR 12 HOURS OR MORE

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Background/Purpose: This study was conducted to investigate stressful experiences in the intensive care unit (ICU) and related factors remembered by patients receiving mechanical ventilatory management for 12 hours or more.

Methods: Adult patients without any cognitive impairment who received mechanical ventilatory management for 12 hours or more while hospitalized in the general ICU of one facility were examined. Structured interviews were held with the patients using the Stressful Experiences in the ICU Questionnaire (a Japanese version was created with the permission of the original author; Cronbach’s \( \alpha \): 0.90) after the decision was made for the patients to be discharged from the ICU and related factors were gathered from medical records. The study was approved by the ethics committee of the authors university.

Results: Subjects comprised 96 patients (mean age: 70.1, men: 74, women: 22), 66.7% of whom had undergone cardiovascular surgery and 26.0% had been admitted emergent. Ten (10.4%) subjects did not remember tracheal intubation. Very stressful experiences included thirst, difficulty speaking, and discomfort of the tracheal tube. Related factors were pain intensity; total amount of narcotic drugs used; intubation time; no prior medical history; being in employment; and C-reactive protein (CRP) levels prior to extubation. Age, days spent in the ICU and days of hospital stay were unrelated.

Conclusions: Discomfort, particularly thirst and pain during intubation, needs to be alleviated in order to reduce the stress of patients admitted to the ICU. Moreover, if possible, patients should be given prior explanations regarding speaking ability and tracheal tubes.

Keywords: Stressful experiences, ICU patients
SYSTEMATIC PAIN ASSESSMENT IN CRITICALLY ILL PATIENTS

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Background/Purpose: Systematic approaches to pain assessment in critically ill patients are of paramount importance in adequate and safe care. Aim: To investigate the impact of a systematic approach to pain assessment on the intensity and incidence of pain and clinical outcomes in critically ill patients.

Methods: Randomized controlled study with critically ill patients randomized in a standard care and an intervention group. The intervention consisted of the Behavioral Pain Scale (BPS) and the Critical Pain Observation Tool (C-POT), which were completed twice daily, by independent observers. In the intervention group, ICU nurses and physicians were notified of the results. Mixed Anova for the interaction effect of group and outcome measurements throughout time was employed.

Results: A total of 98 patients were included (control: n=50; intervention: n=48). There was a significant interaction between group and BPS scale scores throughout the first 3 days (Wilks lamda=0.846, p=0.035 η²=0.154) with intervention group patients exhibiting decreased pain intensity. Similar interactions were observed in the CPOT scale (Wilks lamda=0.856, p=0.052 η²=0.144). There was a trend for lower Incidence of severe pain (BPS>4) in the Intervention group (n=14 - 29.2%) than in Controls (n=20 40%) (p=0.18 Cramers V=0.114). There was no significant difference between control and Intervention group in mortality in ICU (22% vs 19.6%) and in median length of stay (13 [8.5, 22.5] vs 14[9, 22] days).

Conclusions: Systematic assessment of pain may be associated with a decrease in the intensity and incidence of pain. Pain assessment tools should be incorporated into daily ICU practice.

Keywords: Pain assessment, Critically ill, Outcomes
CURRENT PRACTICES OF IMPLEMENTATION OF STANDARDIZED ORAL CARE IN JAPAN

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Background/Purpose: Ventilator associated pneumonia (VAP) increases hospital length of stay by an average of 6 days in the ICU, increases the risk of mortality by 24 to 50%, and contributes to the rising cost of healthcare by approximately $40,000 per event (Kollef 2006, Rello 2002). VAP bundle is a well known preventative measure, however in Japan oral care is not included in the VAP bundle implemented in Japan (Japanese Society of Intensive Care Medicine, JSICM). The most recent VAP bundle from Institute of Healthcare Improvement (IHI 2015) recommends the daily use of chlorhexidine gluconate (CHG), however the use of CHG in Japan have restrictions that makes implementation of this difficult.

Methods: The task force that evaluates clinical guidelines as part of the nursing branch of JSICM conducted a survey of the current practices in ICUs across Japan.

Results: Approximately 50% of the participating institutions reported use of oral care as part of VAP prevention practice. Furthermore, the frequency of other methods of oral care such as evaluation of endotracheal cuff pressure, body positioning, oral brushing and wash, measures to prevent aspiration of oral secretions, prevention of dryness of oral cavity were consistent. However, the lack of implementation of standardized components of oral care and variability amongst institution were observed.

Conclusions: We report the lack of standardized oral care in ICUs across Japan as part of VAP prevention. Furthermore, the use of CHG as part of oral care was not prevalent.

Keywords: VAP oral care
DEVELOPMENT AND APPLICATION OF THE CLINICAL LADDER PROGRAM FOR THE INTENSIVE CARE NURSES IN JAPAN

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Background/Purpose: Intensive care nurses are required advanced nursing skills and ability of high-level clinical judgment, and therefore, to learn the latest extensive knowledge and skills. However, due to the wide variation of each hospital in Japan, each educational system also vary widely, and even some facilities are not available to use educational resources at all. The purposes of this clinical ladder development for Japanese intensive care nurses are the following; 1) improvement of their practical skills, and 2) their proactive career development support.

Methods: From the year 2013 through 2014, the members of the ad hoc committee of the Japanese Society of Intensive Care Medicine, Division of Nursing, took the present status of intensive care nursing in Japan into consideration based on the Dreyfus Model and Nurse Clinical Ladder Program made by Japanese Nursing Association, and developed several goals centering on the required nursing skills and/or the process of individual progress.

Results: We developed four required skills for intensive care nursing (i.e., clinical skills in practice, management skills, proactive career development, nursing ethics) and clinical ladder that constitute 4-step process of progress, and released on our society web-site. We have just begun to apply this ladder to our various educational programs for Japanese intensive care nurses.

Conclusions: This clinical ladder program is just available nationwide. Further research is needed to evaluate the prevalence and/or effect of this program.

Keywords: Clinical ladder program, Intensive care nursing
EVALUATION OF COMFORT LEVELS AND STATE ANXIETY IN PATIENTS WHO UNDERWENT CHEST SURGERY

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Background/Purpose: The study was planned as a descriptive study aimed to determine the comfort levels and state anxiety of patients who underwent chest surgery.

Methods: The universe included all inpatients who were staying at the chest surgery service of a university hospital, while the sample consisted of 112, who were aged between 18-72 years. Data was collected via the face-to-face interview method using the Personal Information Form, the Early Postoperative Comfort Scale, the General Comfort Scale, and the State-Trait Anxiety Scale (STAI).

Results: Mean age of the patients was 51.74. It was found that 63.4% of the patients were male and that 47.3% graduated from primary school. Level of early postoperative comfort was 4.96±0.56 of six and level of general comfort was 2.89±0.32 of four. Level of state anxiety was found to be 49.05±4.50, while level of trait anxiety was 46.37±4.57. Level of early postoperative comfort increased in parallel with general comfort (r=0.23 p<0.001). General comfort and early postoperative comfort were negatively associated with state anxiety (r=-0.210, r=-0.375; p<0.005).

Conclusions: According to the findings, it was determined that chest surgery does not decrease comfort, that there is an inverse relationship between comfort and state anxiety in particular, and that patients who underwent a lengthy operation have higher levels of trait anxiety.

Keywords: Comfort, Nursing, Chest surgery, Postoperative care
PERCEIVED EXPERIENCES OF INTENSIVE CARE PATIENTS

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Background/Purpose: This descriptive study was conducted in order to investigate the physically and emotionally distressing experiences of intensive care patients.

Methods: Study universe consisted of all patients admitted to the reanimation unit between October, 2013 and October, 2014. Study sample included 116 patients who were aged 18 years and above, were hemodynamically stable, were conscious, were in appropriate condition to be transferred to intensive care, and accepted to participate in the study. Prior to the study, written permissions were obtained from the ethics committee and hospital management.

Results: Mean age of the patients was 56.57±15.22. 48.3% were female and 51.7% were male. 82.8% (96) of the patients included those who were probably going to stay in intensive care. Nurses reported that 37.9% of the patients were calm, 6% were precipitous, and 56% were involved. 65 of patients who stayed at intensive care for 2.30±3.89 (1-40) days received mechanical ventilation, 34 received hourly mechanical ventilation, and 17 did not receive mechanical ventilation. Length of receiving mechanical ventilation was 1.97±3.33 days and 4.45±4.48 hours. It was found that the most distressing experiences of patients included thirst, being away from family, pain, aspiration, stomach tube, and not being able to talk. The most comforting experiences of patients included nurses constantly being with them, feeling secure, being informed, breathing easily, and explanations prior to procedures.

Conclusions: Nurses should be aware of these factors which can cause distressing experiences in critical patients and should plan appropriate nursing interventions that can prevent or reduce such experiences.

Keywords: Emotional distressed, Intensive care unit, Intensive care patient, Nursing, Intensive care experience
DETERMINATION OF NURSES WORKLOAD IN INTENSIVE CARE UNIT

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Background/Purpose: It is aimed to calculate necessary the number of nurses by taking basic units/time/nursing initiative factors given to intensive care patients.

Methods: Nurses overlooking the 20 patients in the intensive care units have been observed scope of this descriptive study. Nurse patient ratio has ranged between 1/3 and 1/2 in intensive care units. Dependence levels of patients were evaluated using Cheltenham Patient Classification Scale, Rush Medicus Patients Assessment Level of Addiction Scale. All kinds of nursing functions on the patients diagnosis, treatment and care (direct and indirect patient care functions, service works) were obtained with nursing interventions between 08:20 and 20:08 hours and spent timeline. Data related to nurses work was recorded through direct observation by an observer using a stopwatch. Percentage and average statistical methods were used to evaluate the data.

Results: 55% of patients (n = 11) is high level dependent according to the Cheltenham Patient Classification Scale. According to the Rush Medicus Patients Assessment Level of Addiction Scale, 65% of patients are in the high level dependent patients group at day and night shifts. According to Cheltenham and Rush Medicus Patient Classification, it has been determined that as the patients degree of dependence increases, the workload rises and the workload is more on the night shift than day shift. The workload of a nurse facing two patients in the high level dependent in 12 hours shift was found to be more than 12 hours.

Conclusions: These data showed that a nurse must addicted to a high level dependent patient or a nurse must be considered for a moderate-dependent patient and 2 lower level dependent patients.

Keywords: Nurse, Workload, Intensive care unit
APPROACH OF INTENSIVE CARE NURSES TO EUTHANASIA IN TURKEY

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Background/Purpose: The aim is to reveal the approach of intensive care nurses (ICN) towards euthanasia in Turkey.

Methods: Many countries have been trying, for the past 30 years, to determine their approach to euthanasia by taking their specific conditions into account. Although it is still being debated in Turkey, no extensive legal regulations have been realized yet. Revelatory studies on the approach of nurses, doctors, legislators and the society towards euthanasia are still being conducted. These studies have shown that euthanasia is legally considered to be a crime; and ethically it is open to debate. Opinions of doctors and nurses who usually care for intensive care patients in the terminal phase about euthanasia and patient rights highly contribute to the debates concerning these topics.

Results: Studies of Kumаш (2005), Çınar (2012) and their friends demonstrate that in Turkey, the majority of the ICN is against the legalization of euthanasia. They have expressed their opinion against euthanasia due to religious reasons, the sacredness of the right to life, and conscientious responsibility. They have also stated that in the event of a legalization, they will not participate in the team.

Conclusions: As the ICN defend the other rights of their patients; once the legal basis is formed, they should also take the patients will to die in stride, discharging their duties as patient rights defenders and consultants - even though it may be against their personal opinions and beliefs. It is crucial that the employees are clearly instructed in the euthanasia policies of the hospital.

Keywords: Euthanasia, Patient rights, Nursing approach
NURSING GRIEF IN END-OF-LIFE CARE: PART 2

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Background/Purpose: The highly technical interventions in Intensive Care Units often conflict with compassionate End-of-Life (EOL) care. Part 1 of this initiative revealed that EOL issues in the Coronary Care Unit (CICU) were seldom discussed among interdisciplinary team members. Survey results showed staff nurses perceived they were providing futile treatments. The literature shows emotional distress experienced by nurses can lead to job dissatisfaction, withdrawal form moral dimensions of patient care, and departure from the nursing profession (Allen R. et al., 2013). This presentation will further examine change over the past three years in EOL decision-making practice in CICU and the level of moral distress experienced nurses.

Methods: The same descriptive, open-ended questionnaire used in 2012 will be distributed to staff nurses in CICU of a large, academic teaching center in Toronto. Finding will be compared to the 2012 results to evaluate the work done on Advanced Care Planning and palliation.

Results: This quality improvement project will promote awareness of moral distress that nurses experienced when providing to be medically futile. Lesson learned and next steps for collaboration on EOL care will be presented.

Conclusions: Ethical principles should be the underpinning foundation to guide the decisions and patients be allowed to die with dignity.

Keywords: End-of-Life care
THE IMPACT OF SLEEP DISRUPTION ON DELIRIUM DEVELOPMENT IN CRITICALLY ILL PATIENTS

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Background/Purpose: Many critically ill patients treated in the intensive care unit (ICU) experience sleep disruption. Disrupted sleep in the ICU has been proposed as a potential risk factor for delirium, but previous study is sparse. This study was undertaken to identify the sleep status for the development of delirium in non-sedated critically ill patients.

Methods: This is a prospective study. Polysomnography recording was performed over 24 hour to assess the quantity and quality of sleep. Delirium was measured daily using the Confusion Assessment Method for the ICU.

Results: Total 20 patients were enrolled. Their median APACHE II score was 19 (IQR : 16~27) and total sleep time was 03:43 (hh:mm, IQR: 00:49 - 06:10). The majority of sleep was stage 1 (median 03:02 [00:47 - 04:34]) with scant stage 2 (median 00:00 [00:00 - 00:46]), REM (median 00:00 [00:00 - 00:15]) and absent stage 3. Delirium was developed in 4 patients (20%). Delirium incidence was independently associated with the duration of ICU stay more than 5 days in multivariable analysis (P=0.042). We also found that patients who stayed 5 days or more in ICU showed significant reduction in night sleep time compared to patients who did not (00:42 ± 0:46 vs 2:04 ± 1:25, P=0.012), despite of similar total sleep time.

Conclusions: The quantity and quality of sleep in critically ill patients were poor. The long duration of ICU stay disrupted circadian rhythm which could contribute to the development of delirium in critically ill patients.

Keywords: Intensive care unit, Sleep, Delirium, Polysomnography
PREVALENCE REVIEW OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS IN RESOURCE LIMITED SETTING

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Background/Purpose: Prolonged illness, higher cost of healthcare and greater risk of death were associated with infections caused by resistant microbial agents WHO (2013). Hospital environment provide a substantial source of hospital acquired pathogens, particularly in setting with poor infection control strategies. Although regular cleaning have been found to disturb the ecological niches found by potentially pathogenic organisms in settings with efficient environmental cleaning and infection control measures, however, there is still occurrences of difficult to treat multiple drug resistant pathogens like MRSA. With this in mind, it becomes imperative to review the prevalence of MRSA in critical care setting in Nigeria.

Methods: Literature search PubMed was searched in January 2015, the following search term was applied; MRSA, prevalence, ICU Nigeria. In addition, search were performed on using Google search engine, MRSA prevalence, ICU, Nigeria, were used as search words. Study selection any study published providing data related to MRSA in Nigeria were considered and included for review and data extraction.

Results: Based on PubMed result only one research was found dealing with molecular epidemiology of MRSA by Taiwo SS. and colleagues (2005). Google search results reveals numerous studies, however only few were included based on their relevance to this topic under review.

Conclusions: In conclusion, although there was some documented studies focusing on carriage of MRSA among healthcare workers particularly in ICUs and fomites contamination, there was limited studies on the prevalence of MRSA in Nigerian ICUs. Equally, improved infection control practices could reduce the cross transmission between ICU staff, environment and patients.

Keywords: MRSA, Review, Prevalence, Intensive care unit, Nigeria
VALIDITY OF THE RESP, PRESERVE AND ECMONET SCORES FOR ECMO IN CHILDREN WITH ARDS

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Background/Purpose: As increasing use of extracorporeal membrane oxygenation (ECMO) for acute respiratory distress syndrome (ARDS) in children, the strategy for survival prediction is crucial but not standardized. We evaluated the scoring systems of survival prediction for adults to pediatric ARDS and validate them.

Methods: Data from 11 children with ARDS treated by ECMO from 2013 to 2014 were analyzed and applied to the previous scoring systems including the RESP, the PRESERVE, and the ECMOnet scores. We compared those scores and clinical characteristics between survivors and non-survivors.

Results: Mortality was 72.7% (8/11). The PRESERVE score (survivors vs. non-survivors; 2 vs. 5.25, p=0.048), and the ECMOnet score (4.1 vs. 5.63, p=0.048) were lower in survivors than in non-survivors, but they didn’t perform well regarding with survival prediction. There is even no difference in the RESP score (-4.33 vs. -2.62, p=0.63) between them. The parameters showed consistent effects on survival in this study, which were duration of mechanical ventilation, PIP and PaCO2 prior to initiation of ECMO from the RESP score, PIP and PEEP from the PRESERVE score, bilirubin, hematocrit, creatinine from ECMOnet score. The parameters such as CNS dysfunction in the underlying disease didn’t work for children, while all children under immunocompromised state died and should be considered the more important factor in children.

Conclusions: This is the first pilot study to predict survival in pediatric ARDS with ECMO. It is necessary to establish a tool to predict survival after ECMO for pediatric ARDS due to limitation of the previously reported scores for adults.

Keywords: Extracorporeal membrane oxygenation, Acute respiratory distress syndrome
EFFECTS OF LEISURE SATISFACTION AND JOB STRESS ON JOB SATISFACTION IN KOREAN NURSES

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Background/Purpose: Many studies have been explored the factors associated with job satisfaction for nurses over the world. Although nurses stresses have been shown to affect their job satisfaction, little is known about whether both leisure and job stress are having relationship with job satisfaction. The purpose of this study was to explore the factors including leisure satisfaction and job stress associated with nurses’ job satisfaction in South Korea.

Methods: A total 292 nurses who were working at the University hospital participated in this cross-sectional study. For analyzing the predictors on job satisfaction, the key variables were entered the order of the variables such as demographics, job related characteristics, nurses stress and leisure satisfaction in multivariate regression analysis.

Results: Using hierarchical multiple regression analysis and after controlling for socio-demographics, job satisfaction was influenced by leisure satisfaction and nurses stress regarding patients death and lack of supplies in the final model. Those who had higher leisure satisfaction had better job satisfaction. In contrast, nurses who had higher job stress about patients’ death and lack of supplies had lower job satisfaction. The final model explained about 21.6% of the variance in job satisfaction.

Conclusions: Leisure satisfaction and nurses’ stress were significantly associated with job satisfaction in hospital nurses. Our findings suggested that leisure activity should be encouraged individually and supported by organizational aspect for enhancing the job satisfaction. Further research needs to be conducted to explore potential mechanism on how to explain the relationship between leisure satisfaction and job related factors using structure equation model.

Keywords: Nurse, Stress, Satisfaction, Leisure
IMPACT OF RAPID RESPONSE TEAM (RRT) ACTIVITY DURING POSTOPERATIVE PERIODS IN ORTHOPEDIC SURGERY DEPARTMENT

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Background/Purpose: The purpose of the study is to evaluate the impact of rapid response team (RRT) activity during the post-operative period.

Methods: From Mar 2014 to Dec 2014, a total of 1171 patients were electronically screened during the post-operative period for at least 24 hours in department of orthopedic surgery, St. Mary’s hospital. Among them, 1129 were discharged without serious adverse events (SAEs), 30 were activated by requests of attending doctors or nurses or the electronic medical alert system and 12 had SAE without RRT activation. We compared the clinical characteristics and progress of 30 activated and 12 non-activated patients by retrospective chart review.

Results: The most common SAE was pulmonary origin. Mean modified early warning scores (MEWS) at admission and post-operative day 1 (POD 1) were higher in activated patients (2.3 vs. 1.08, P = 0.009 / 2.4 vs. 0.8, P = 0.000), but APACHE II score at POD 1 were not statistically different. After the activation, 16 (53.3%) patients were stabilized in general ward, 13 (43.3%) were transferred to intensive care unit (ICU). The percentage of CPR and mortality were higher in non-activated group (13.3% vs. 25%, P = 0.063, 10% vs. 41.7%, P = 0.031).

Conclusions: At-risk patients with higher MEWS at admission and POD1 were prone to activate RRT and be undertaken successful intervention during the postoperative period. But the patients who were not detected by electronic medical alert system or attending physician showed higher rate of CPR and mortality. Further development of postoperative screening system would be needed.

Keywords: Rapid response team, Postoperative period, Modified early warning scores
THE EFFECTS OF THE APPLICATION OF A GLUCOSE CONTROL PROTOCOL ON GLYCEMIA AND GLUCOSE VARIABILITY IN CRITICALLY ILL PATIENTS

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Background/Purpose: The present study sought to determine the state of blood glucose control and the consequent clinical effects and variation in the blood glucose level by comparing the blood glucose levels of patients admitted to intensive care unit (ICU) following cardiovascular surgeries on adults before and after the application of a blood glucose control protocol.

Methods: With patients admitted to ICU following cardiovascular surgeries as the objects, the resulting blood glucose data on an experimental group (n=314) to which the blood glucose control protocol had been applied and a control group (n=347) whose blood glucose levels had been controlled according to physicians prescriptions without the protocol were collected through medical records.

Results: The target blood glucose (110-150mg/dL) ratio increased significantly in the experimental group, and the low blood glucose (60mg/dL or below) ratio decreased significantly in the experimental group. The two groups exhibited a significant difference in the degree of variation in the blood glucose levels. In particular, cases where the degree of variation in the blood glucose levels had amounted to 80mg/dL or above were significantly more numerous in the control group. The duration of the use of a medical ventilator was significantly reduced in the experimental group.

Conclusions: When the blood glucose control protocol was applied to critically ill patients, it was possible to control the blood glucose while raising the target blood glucose ratio and maintaining minimal variation in the blood glucose. Consequently, the use of the present protocol is expected to make possible the safe and effective control of blood glucose levels of critically ill patients.

Keywords: Critical care, Clinical protocol, Blood glucose
COMPARISON OF MEDICAL EMERGENCY TEAM CALLING PATTERN BY DOCTOR AND NURSE IN GENERAL WARD

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Background/Purpose: General ward doctors and nurses call Medical Emergency Team (MET) for the discussion and advanced management after detecting deteriorating patients. But, it is not known whether ward doctors and nurses have different recognition and response to high-risk patient. This study was compared the vital sign parameter between doctors call and nurses call at the primary point of MET.

Methods: We analyzed cohort data of MET activation by doctors and nurses on general ward retrospectively. We collected each vital sign parameter, oxygen supply, O2 saturation, Glasgow Coma Scale, Modified Early Warning Score (MEWS) at the primary point of MET call, from January 2014 to December 2014.

Results: We enrolled 533 patients. Doctors’ call was 361 (67.7%), nurses’ call was 172 (32.2%) patients. Among vital sign parameters at the primary point of MET call, Respiration Rate and Body Temperature were significant (p<.05). MEWS was higher in nurses call (p<.001). Transfer to Intensive Care Unit and hospital mortality were lower in Nurses call (p<.05). As compared to call time, Night (7p.m.-7a.m.) call was higher in nurses’ call (55.8%). In doctors’ call, 47.4% was associated other causes such as laboratory data or clinical judgement.

Conclusions: In this study, ward doctors and nurses showed the differences in the factors that determine the MET call for deteriorating patients. Nurses call is showed higher compliance on the calling criteria and good prognosis these patient. Therefore, we suggest that it is important to use calling criteria for doctors.

Keywords: Rapid response system, Medical emergency team, Calling criteria
Table 1. Comparison of the between Doctor’s call and Nurse’s call

<table>
<thead>
<tr>
<th>Variables</th>
<th>Doctor’s call (n=361)</th>
<th>Nurse’s call (n=172)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEWS</td>
<td>5 (3-6)</td>
<td>6 (4-7)</td>
<td>&lt;001</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>114 (94-137)</td>
<td>112 (88-139)</td>
<td>.491</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>69 (56-80)</td>
<td>68 (52-80)</td>
<td>.656</td>
</tr>
<tr>
<td>Heart Rate (bpm)</td>
<td>106 (90-126)</td>
<td>111 (90-131)</td>
<td>.192</td>
</tr>
<tr>
<td>Respiration Rate (bpm)</td>
<td>24 (20-30)</td>
<td>26 (22-32)</td>
<td>.005</td>
</tr>
<tr>
<td>Body Temperature (°C)</td>
<td>36.8 (36.5-37.6)</td>
<td>36.6 (36.3-37.3)</td>
<td>.003</td>
</tr>
<tr>
<td>Oxygen Saturation (%)</td>
<td>35 (21-44)</td>
<td>30 (24-50)</td>
<td>.644</td>
</tr>
<tr>
<td>GCS</td>
<td>15 (12-15)</td>
<td>15 (11-15)</td>
<td>.159</td>
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<tr>
<td>Outcome</td>
<td></td>
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<td></td>
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<tr>
<td>General ward</td>
<td>214 (59.3)</td>
<td>121 (70.3)</td>
<td>.013</td>
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<td>Intensive care unit</td>
<td>147 (40.7)</td>
<td>51 (29.7)</td>
<td>.013</td>
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<td>28days mortality</td>
<td>124 (34.3)</td>
<td>52 (30.8)</td>
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<td>Hospital mortality</td>
<td>142 (39.3)</td>
<td>51 (29.7)</td>
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<td>Time</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Day (7a.m.-7p.m.)</td>
<td>208 (57.6)</td>
<td>76 (44.2)</td>
<td>.004</td>
</tr>
<tr>
<td>Night (7p.m.-7a.m.)</td>
<td>153 (42.4)</td>
<td>96 (55.8)</td>
<td>.172</td>
</tr>
</tbody>
</table>

Table 2. Contained among the Calling criteria between Doctor’s call and Nurse’s call

<table>
<thead>
<tr>
<th>Variables*</th>
<th>Doctor’s call (n=361)</th>
<th>Nurse’s call (n=172)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>171 (47.4)</td>
<td>55 (32.0)</td>
<td>&lt;001</td>
</tr>
<tr>
<td>1</td>
<td>142 (39.3)</td>
<td>79 (45.5)</td>
<td>.148</td>
</tr>
<tr>
<td>2</td>
<td>38 (10.5)</td>
<td>31 (18.0)</td>
<td>.016</td>
</tr>
<tr>
<td>3</td>
<td>9 (2.5)</td>
<td>7 (4.1)</td>
<td>.319</td>
</tr>
<tr>
<td>4</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
<td>-</td>
</tr>
</tbody>
</table>

* The number included Calling Criteria.
Calling criteria: Systolic Blood Pressure<90mmHg, Heart Rate<40 bpm or Heart Rate>140 bpm, Respiration Rate>6 bpm or Respiratory Rate>30 bpm, Oxygen supply FiO2>0.4 on O2 saturation<90%.

12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS 972
INITIAL CHANGE OF POSITION AFTER CARDIOVASCULAR SURGERY AND ITS RELATIONSHIP WITH ORGANIZATION CHARACTERISTICS

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Background/Purpose: Early rehabilitation after cardiovascular surgery improves prognosis and quality of life of the patients. However, current practice of changing patients position is unknown. Therefore, a mail survey was conducted to elucidate the relationship between the practice and organization characteristics.

Methods: Randomly selected 200 hospitals were invited to participate the survey. Among them, 60 directors of nursing with 1092 staff nurses agreed to participate. Characteristics of the hospitals, ICUs, and cardiovascular patients were reported by nurse managers. Staff nurses were asked to report changing position of most recent cardiovascular patients. Relationship between timing of initial change in position and characteristics of the organization was statistically analyzed.

Results: 47 nurse managers (77%) and 525 (48%) staff nurses responded. The median bed capacity of the hospitals was 542 (max 1262, min 77). The median time from the patients admission to the ICU and the nurses first consideration of the initial change of position was 240 minutes. 42 ICUs (91%) did not have protocol of initial change of position. There was no significant difference in consideration time of initial change of position between ICUs with and without protocol (p=0.870). Weak negative correlations were seen between consideration time of initial change of position and each larger total bed capacity (p=0.135, p=0.010), larger ICU bed capacity (p=0.195, p<0.001), cardiac surgeons (p=0.14, p=0.007), and full-time ICU physicians (p=0.372, p=0.001).

Conclusions: Nurses in hospitals with larger total bed capacity, larger ICU bed capacity, more cardiac surgeons, and more full-time ICU physicians tended to think of changing position earlier.

Keywords: Early rehabilitation, Cardiovascular surgery, Organization characteristics
FACTORS ASSOCIATED WITH PARTICIPATION OF CARDIAC REHABILITATION AFTER PERCUTANEOUS CORONARY INTERVENTION

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Background/Purpose: This is a descriptive study to identify the factors associated with participation of cardiac rehabilitation after percutaneous coronary intervention, and to evaluate the effect of cardiac rehabilitation on disease-related knowledge and health behavior.

Methods: Data were collected from 121 patients who received percutaneous coronary intervention at YUMC in Seoul, Korea. This study investigated health beliefs, coronary artery disease-related knowledge, and healthy behavior implementation via the self-reporting questionnaire; medical records were analyzed to obtain subject information regarding body mass index, associated diseases, blood test results, and coronary intervention results.

Results: The cardiac rehabilitation program participation level was higher in women, those of high economic status, non-drinkers, those that were hospitalized as outpatients, those with low coronary artery disease severity, and those with more health behavior prior to hospitalization. The overall score related to coronary artery disease-related knowledge was high in the group that participated in the cardiac rehabilitation program; they were especially knowledgeable in the areas of disease risk factors, medication, exercise and lifestyle. The participants of cardiac rehabilitation showed more health behaviors; especially in the areas of continuous disease management, dietary control, exercise, and management of lifestyle and emergency situations.

Conclusions: A strategy to encourage coronary intervention patients to participate in the cardiac rehabilitation program can be drawn from the influencing factors derived from this study. This could be done by explaining at the onset of the program that there is potential for coronary disease to worsen or relapse, and by emphasizing that restenosis can be prevented by the cardiac rehabilitation program.

Keywords: Cardiac rehabilitation, Participation factors, Barriers to participation, Coronary artery disease, Health behavior
EFFECTS OF A PSYCHO-COGNITIVE NURSING INTERVENTION ON CRITICAL CARE PATIENTS: PAIN AND ANXIETY LEVELS

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Background/Purpose: In critical illness, adverse emotions, anxiety and pain influence patients’ psychological and physiological outcomes. We aimed to investigate the effects of a composite psycho-cognitive nursing intervention on pain and anxiety levels in critically ill patients.

Methods: Randomized controlled trial with sixty ICU patients randomized to an intervention or standard care group. The 60-min intervention consisted of presence, touch, relaxation, guided imagery, and music listening (for up to 5 days). Inclusion criteria included age ≥18, GCS ≥ 9 and understanding Greek. Patients were assessed in the mornings, pre- and post- intervention. Outcome measures included pain ratings [3 scales: 10-point numeric rating scale (NRS), behavioral pain scale (BPS), critical-care pain observation tool (CPOT)] and self-reported anxiety and Relaxation/calm (NRS). The study was blinded to caregivers and outcome assessors. Statistical analysis included Analysis of Covariance on the gain scores while adjusting for age and pre-treatment measurement.

Results: In the intervention group, significant decreases in pain ratings compared to the control group were observed on day 1, with regard to NRS (mean difference (DM): -1.64±1.14 vs. 0.07±0.87; p<0.0001 eta2=0.423), CPOT (DM: -1.31±1.19 vs. -0.07±0.58; p<0.0001 eta2=0.332) and BPS (DM: -1.13±0.92 vs. -0.07±0.58; p<0.0001 eta2=0.389). The intervention group also exhibited increased relaxation/calm levels (DM: 1.25±1 vs. -0.19±1.11; p=0.03 eta2=0.143), and decreased anxiety levels (DM: -1.20±1.32 vs. -0.07±0.52; p=0.009 eta2=0.202). Similar trends were observed throughout the study.

Conclusions: Nursing interventions that combine relaxation, imagery and music may improve critically ill patients’ outcome and experience of care.

Keywords: Critical illness, Intervention, Relaxation, Imagery, Outcomes
RISK FACTORS AND OUTCOMES ASSOCIATED WITH UNPLANNED ICU READMISSION AFTER CARDIAC SURGERY

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Background/Purpose: The purpose of this study was to analyse the risk factors and clinical outcomes associated with unplanned intensive care unit (ICU) readmission after cardiac surgery to improve the quality of ICU care and to provide the basic data for reducing readmission rates to ICU.

Methods: The subjects were 1,368 patients admitted to cardiovascular surgery ICU after cardiac surgery from Jan. 1, 2012 to Jun. 30, 2013. Data were analyzed using chi-squared test, Fisher exact test, and logistic regression test.

Results: The admission rate was 5.9% and the most common readmission cause was cardiac problem and the time interval between ICU discharge to readmission is 172.3 hours (range 10.8-1306.5). Pre-operative risk factors were comorbidities, mechanical ventilation, and admission via other ICU. Peri-operative factors were non-elective surgery, duration of cardio-pulmonary bypass time $\geq$ 3hr, and operative time $\geq$ 5hr. Post-operative factors were mechanical ventilation time $\geq$10 hr, prolonged inotropic drugs infusion especially dobutamine, new onset arrhythmia, unplanned reoperation, massive blood transfusion, and complication. Laboratory data associated readmission were fasting blood sugar, hemoglobin, alanine aminotransferase, C-reactive protein, and APACHE II score on day of discharge to general ward was one of significant factors. In-hospital stay was longer and late mortality was higher for readmission group. The common cause of readmission within 7 days after ICU discharge was cardiac problem and common cause after 7 days were septic condition and wound problem.

Conclusions: Knowing the risk factors associated with ICU readmission would be evidences to decrease readmission after cardiac surgery and determine the optimal discharge time in ICU.

Keywords: Readmission, Intensive care unit, Cardiac surgery
INVESTIGATION OF FACTORS AFFECTED THE QUALITY OF LIFE IN INTENSIVE CARE NURSES WITH LOW BACK PAIN

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Background/Purpose: The studies demonstrated the potential for damage to the psychological, physical, and emotional aspects of nurses working in an intensive care units (ICUs) and they experienced low back pain (LBP). This study aimed to investigate factors affected the quality of life (QoL) in intensive care nurses with LBP.

Methods: A questionnaire included questions related to demographic, psycho-social status at work (PSSW) and job characteristics was administered. The pain intensity (Visual Analogue Scale), disability (Oswestry Disability Index [ODI]), QoL (36-Item Short Form Health Survey [SF-36]) and sleepiness (Epworth Sleepiness Questionnaire [ESQ]) were evaluated.

Results: Sixty six nurses (mean age: 30.93 ± 2.36 years) working in different ICUs, who had LBP, participated in the study. The general health (p=.001), changes in health during the last year (p=.007), physical function (p=.000), role physical (p=.006), social functioning (p=.001) and bodily pain (p=.002) scores of SF-36 were adversely correlated with ODI score. The changes in health during the last year (p=.038) and physical function (p=.010) scores of SF-36 were related to total working duration, negatively. There was correlation between bodily pain of SF-36 and numbers of patients receiving care (p=.036). The SF-36 scores’ associations with age, BMI, education duration, working duration/day, working duration/week, ESQ and PSSW scores were poor (p>.05).

Conclusions: The results of this study suggest that QoL of intensive care nurses with LBP was especially affected with disability. Therefore, factors caused disability should be analyzed and applicable expediences should be developed to improve QoL of intensive care nurses.

Keywords: Intensive care nurses, Quality of life, Disability, Psycho-social status, Sleepiness
KNOWLEDGE OF MAINTENANCE INTRAVENOUS FLUID THERAPY IN ACUTELY ILL HOSPITALIZED CHILDREN AMONG RESIDENTS

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Aga Khan University Karachi, Pakistan

Background/Purpose: Isotonic saline is recommended as maintenance intravenous fluid therapy (MIVFT) for most of the acutely ill hospitalized children. The aim of this study is to assess the current knowledge of pediatric residents regarding the selection of MIVFT in hospitalized children.

Methods: We conducted a paper-based questionnaire survey to pediatric residents from ten centers asking selection of MIVFT in four common clinical scenarios in 6-month and 10-year old patients as well as monitoring of fluid balance and electrolytes.

Results: 445 responses were collected (>90% response rate). Majority [78.3% (n=348)] of them were FCPS-trainees. The 0.9%, 0.45% and 0.2% solution were selected by 45.8%, 43.98% and 10.92% respectively. The isotonic and hypotonic solution was prescribed in 6-mo (35.22% vs. 64.76% [p<0.001]) and 10-yr (54.49% vs. 44.98%) in four different clinical scenarios respectively. 0.45% solution was most commonly prescribed MIVFT in pneumonia (50.22%) and meningitis (45.39%) and 0.9% solution was most commonly selected in acute gastroenteritis (50.22%) and post-operative patients (51.23%). Fluid balance and electrolyte monitoring were selected by 96.9% and 55.7% respondents respectively.

Conclusions: Our survey reports that more than fifty percent of pediatric residents have inadequate knowledge about maintenance intravenous fluid therapy in acutely ill hospitalized children.

Keywords: Children, Intravenous fluid maintenance, Knowledge
RENAL REPLACEMENT THERAPY OF PEDIATRIC LYMPHOPROLIFERATIVE STATE

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Background/Purpose: Lymphoproliferative conditions, such as acute lymphoblastic leukemia (ALL), are rare but life-threatening among pediatric populations. Intensive care might be necessary in tumor lysis syndrome (TLS) by chemotherapy. Although renal replacement therapy (RRT) will be considered in acute kidney injury (AKI), the indication is not concretely established especially among pediatric patients with TLS. Objectives: To establish the indication of RRT in pediatric patients, who are treated against lymphoproliferative diseases.

Methods: Retrospective research of medical files of the pediatric (<18yrs) patients who were treated in the emergency & medical intensive care unit (EMICU) in Nagoya University Hospital during June 2012 and March 2015.

Results: 1,855 patients admitted to the EMICU, among which 192 were less than 18 years old. 80 were suffering from neoplastic disorders, including 15 ALL and 6 lymphoma. Rasburicase was administered to all of them to successfully limit serum uremic acid within normal range. Among 15 ALL patients, 4 patients (1 mo - 15 yo [5mo]) underwent plasmapheresis before chemotherapy, whose white blood cell count exceeded 300,000/mm3, and none of them suffered from TLS to need RRT. On the other hand, 2 patients with Burkitt lymphoma were accompanied by TLS. Anuria and high serum uremic acid were seen in a 4 yo boy, and hyperphosphatemia and elevated creatinine in an 11 yo girl. RRT was adopted on day 0 and day 5, respectively.

Conclusions: Plasmapheresis reduced the risk of TLS among ALL patients. Rasburicase effectively decreased serum uremic acid level, which might lead to the delay of starting RRT.

Keywords: Pediatric, Acute lymphoblastic leukemia, Burkitt lymphoma, Tumor lysis syndrome, Renal replacement
EXPERIENCE OF MECHANICAL CIRCULATORY SUPPORT FOR MEDICALLY INTRACTABLE LOW CARDIAC OUTPUT

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Seoul National University Hospital, Republic of Korea

Background/Purpose: Mechanical circulatory support with extracorporeal membrane oxygenation (ECMO) and ventricular assist device (VAD) has been always optimal choice for treating the majority of medically intractable low cardiac output. We retrospectively investigated the usefulness of mechanical circulatory support.

Methods: From 1999 to 2014, 86 patients underwent mechanical circulatory support for medically intractable low cardiac output with ECMO or VAD in our pediatric intensive care unit. There were 51 (59.3%) males and their median age was 0.78 years (range: 1 day - 41.6 years). Indications included postcardiotomy heart failure in 60, dilated cardiomyopathy in 13, rescue therapy during cardiopulmonary resuscitation in 8, and acute myocarditis in 5.

Results: Of these 86 patients, 45 (52.3%) patients were successfully weaned from the mechanical assist device. One patient of acute myocarditis was initially supported by ECMO, and successfully bridged to VAD support. Five patients of dilated cardiomyopathy were successfully bridged to cardiac transplantation. Twenty five (29.1%) survivors were able to be discharged from the hospital. Dilated cardiomyopathy and myocarditis are associated with better survival, but early age and univentricular physiology decreased survival. Survival was also dramatically improved since 2010.

Conclusions: Mechanical circulatory support with ECMO and VAD play important role and have dramatic effect on survival in children with medically intractable heart failure, particularly in recent years. More early and liberal applications are warranted to achieve even better outcomes, particularly in the very young patients with complex anomaly.

Keywords: Low cardiac output, Mechanical support, Resuscitation
ON TABLE EXTUBATION AFTER OPEN HEART SURGERY IN CHILDREN: AN EXPERIENCE FROM A TERTIARY CARE HOSPITAL IN A DEVELOPING COUNTRY

Qalab Abbas, Anwar Ul Haq
Aga Khan University Karachi, Pakistan

Background/Purpose: Recent advances in various disciplines of medicine have significantly changed the courses following cardiac surgery in children. On table extubation (OTE) after open-heart surgery in children is evolving. We assessed the rate of postoperative complications in children extubated on table after open heart surgery.

Methods: This is a retrospective, descriptive study. All pediatric patients (between 0-18 years) undergoing open heart surgery between January 2011 and June 2013 were included, they were extubated in Operating Room (OR) then admitted to the Pediatric intensive care unit (PICU). Rate of immediate postoperative complications such as re-intubation, significant bleeding, low cardiac output syndrome, arrhythmia in Pediatric Intensive Care Unit were assessed. Data are presented as frequencies and mean ± SD.

Results: Of the total 82 patients, mean age at time of operation was 7.25 ± 6.6 yr. Fifty three percent (n=44) were < 5yr old and 64% (n=53) were males. Ventricular septal defect (47%, n=39) was the most common lesion, followed by atrial septal defect (36%, n=30), and Tetralogy of Fallot (15%, n=12), that were repaired. Cardiopulmonary bypass and aortic cross clamp time were 72.3 ± 34.2 and 47.3 ± 27.8 minutes, respectively. The mean inotrope score was 2.66 ± 3.53. There was no mortality in the cohort while 97.8% (n=80) had no complications during PICU stay. One patient (1.1%) required re-intubation for respiratory failure and one patient (1.1%) had arrhythmia that was medically managed. The mean length of PICU stay was 1.77±0.985days.

Conclusions: On table extubation in children after open heart surgery was feasible and safe in selected group of patients with no major complication.

Keywords: On table extubation, Cardiac surgery, Children
MUTATIONS IN THE BSCL2 GENE CAUSE CONGENITAL GENERALIZED LIPODYSTROPHY COMPLICATED BY SEVERE ACUTE PANCREATITIS

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Background/Purpose: Congenital generalized lipodystrophy (CGL), a rare clinical disease, belongs to the genetically autosomal recessive disorder. Usually, CGL has special physical characteristics, accompanying with multiply metabolic dysfunction. As reported previously, AGPAT2 and BSCL2 mutations might be related to CGL. However, the pathogenic mechanism of CGL is unclear. We aimed at study the pathogenic mechanism of BSCL2 gene in one patient with CGL.

Methods: Through preliminary clinical diagnosis, we diagnosed the patient as CGL. Furthermore, by gene sequencing, we analyzed the eleven exons and mutation sites in the BSCL2 gene of the patient.

Results: We found that there were mutations in the BSCL2 gene which encoded the unknown function transmembrane protein Seipin. The mutations resulted in the changes of the fourth exons and the termination of protein translation.

Conclusions: These might lead to the change of protein function and the outbreak of the disease. In a word, the CGL patient was diagnosed from two aspects of experimental and clinical analysis. In addition, this study was the first report about one case of CGL complicated by severe acute pancreatitis. Taken together, these findings may shed light on the mechanism of CGL.

Keywords: Congenital generalized lipodystrophy, BSCL2, Mutation, SAP
PREDICTORS AND OUTCOME OF ACUTE KIDNEY INJURY IN CHILDREN WITH DIABETIC KETOACIDOSIS ADMITTED TO A PEDIATRIC INTENSIVE CARE UNIT: A DEVELOPING COUNTRY EXPERIENCE

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Background/Purpose: To study the predictors and outcome of Acute Kidney Injury (AKI) in children with diabetic ketoacidosis (DKA) admitted to a Pediatric Intensive Care Unit (PICU) of a tertiary care referral hospital in North India.

Methods: Records of 79 children with DKA admitted from Jan 2011 to Dec 2014 were analyzed retrospectively for demographics, pre-referral management, presence of co-morbidities, biochemical parameters at admission, 12 and 24 hours, complications and outcome. AKI was defined by pRIFLE criteria.

Results: Mean (SD) age and boys: girls ratio of study group was 7 (3.7) years and 1.3:1 respectively. Fifty nine (74.7%) had severe DKA at presentation. AKI with pRIFLE 2 or 3 was seen in 28 (35.4%), of which 20 (71.4%) resolved spontaneously and 8 (28.6%) required renal replacement therapy (RRT). Need for RRT was predicted by pRIFLE at 12 hours with sensitivity and specificity of 87.5% and 90.1% respectively. On univariate analysis, children with AKI had significantly higher incidence of severe sepsis (p=0.001), need for vasoactives (p=0.012), and ventilation (p=0.005) and longer time [Median (IQR hours)] for DKA resolution [31 (24-76.5) vs 26(20-35), p=0.006] and PICU discharge [3 (2-4.8) vs 2 (1-2), p=0.0001]. Seven (8.8%) children died; 6 had AKI with severe sepsis. On multivariate analysis severe sepsis at admission was an independent predictor for AKI [OR12, 95% CI 1.2-119; p=0.03] and mortality [OR 33.8, 95% CI 2.6-443.5; p=0.007].

Conclusions: One-third of children with DKA had AKI, which resolved spontaneously in majority. However severe sepsis associated with AKI carried a poor prognosis.

Keywords: Diabetic ketoacidosis, Acute kidney injury, Severe sepsis, Predictors, Outcome
COMPARING PREVALENCE AND PREDICTORS OF BREASTFEEDING BY GESTATIONAL AGES IN LATE PRETERM INFANTS

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Background/Purpose: The purpose of this study was to compare the prevalence of breastfeeding in three different gestational ages and to determine factors which affect Late Preterm Infants (LPI) to be breastfed.

Methods: In this prospective study, medical records were reviewed to investigate types of feeding during hospitalization, the characteristics of LPIs and their mothers. Participants were LPIs of 34 weeks (n=70), 35 weeks (n=75) and 36 weeks (n=88). Data were collected for 4 months at nursery or neonatal intensive care unit from four university hospitals in Korea. Descriptive statistics and odds ratio were used to compare three groups (LPIs at 34, 35, and 36 weeks).

Results: The prevalence of breastfeeding investigated at 1st week of LPI discharge was 32.9%, 37.3%, 23.9% at 34, 35, and 36 weeks, respectively. The likelihood of breastfeeding in 34 weeks LPIs was lower with the LPIs born by cesarean-section (OR 0.14, 95% CI 0.03-0.68), while it was higher in the LPIs with longer period of breastfeeding during hospitalization (OR 1.14, 95% CI 1.01-1.28) and their body weight at the first day of feeding (OR 26.49, 95% CI 2.02-348.21). The prevalence of breastfeeding in LPIs of 35/36 weeks was higher with the history of more frequent breastfeeding (OR 7.97, 95% CI 1.43-44.52 of 35 weeks, OR 40.74 95% CI 3.62-458.14 of 36 weeks).

Conclusions: The prevalence of breastfeeding in LPIs was significantly lower than that of term infants. This suggests that health care providers should give more careful educations to LPIs mothers emphasizing breastfeeding while the dyads stay in hospitals.

Keywords: Late preterm infant, Breastfeeding, Neonatal intensive care unit
DEVELOPMENT OF PEDIATRIC NEUROLOGIC EMERGENCY LIFE SUPPORT COURSE: A PRELIMINARY REPORT

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Background/Purpose: Acute neurological emergencies (ANEs) in children are common life-threatening illnesses, and are associated with high mortality and severe neurological disability in survivors if not recognized early and treated unappropriately. We describe our experience of teaching a short, novel course Pediatric Neurologic Emergency Life Support (PNELS) to pediatricians and trainees in a resource-limited country.

Methods: This course was conducted at 5 academic hospitals from November 2013 to December 2014. It is a hybrid of Pediatric Advance Life Support and Emergency Neurologic Life Support. This course is designed to increase knowledge and impart practical training on early recognition and timely appropriate treatment in the first-hour of children with ANEs. Neuroresuscitation and neuroprotective strategies are key components of this course to prevent and treat secondary injuries. Four cases of ANEs: Status Epilepticus, Non-traumatic Coma, Raised Intracranial Pressure and Severe Traumatic Brain Injury were taught as a case simulation in a stepped-care, protocolized approach based on best clinical practices with emphasis on key points of managements in the first-hour.

Results: Eleven courses were conducted during the study period. One hundred-ninety six physicians including 19 consultants and 171 residents participated in these courses. The mean score was 65.15 ± 13.87%. 70% (132) of participants were passed (Passing score > 60%). The overall satisfaction rate was 85%.

Conclusions: PNELS was the first-time delivered educational tool to improve outcome of children with ANEs with good achievement and high satisfaction rate of participants. A large number courses is required for future validation.

Keywords: Acute neurological emergencies, Children, Course
ETIOLOGY, PRESENTATION AND OUTCOME OF SPONTANEOUS INTRACRANIAL HEMORRHAGE IN PEDIATRIC INTENSIVE CARE UNIT (PICU) OF A DEVELOPING COUNTRY

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Aga Khan University Karachi, Pakistan

Background/Purpose: Intracranial hemorrhage (ICH) in children is a rare but disabling disease that accounts for almost half cases of stroke. Much remains to be known about its epidemiology, etiology and outcome. We report our experience of childhood ICH.

Methods: Retrospective review of medical records of children (1 mo - 18 years) admitted in PICU (a closed, multidisciplinary-cardiothoracic) between Jan 2007-Dec 2014 was done after approval from ethical review committee. Collected data included age, gender, presentation, examination findings, neuroimaging done (CT, MRI, angiography) and its findings, management (conservative / intervention) and outcome. Results are presented as frequency and percentages.

Results: Of the total 51 patients, 57% were male and 25% were <1 year. On presentation 43% had vomiting, 41% had seizures and GCS <8 while 39% had altered level of consciousness. Single bleeding was present in 86%, 92% had supratentorial bleeding and 34% had intraventricular extension. Majority (72%) had volume <30 ml and 8% had >60ml. CT scan was done as initial investigation in 96% patients, MRI was done in 33% while 6% underwent conventional angiography. 59% patients were managed conservatively, 35% underwent neurosurgical intervention and 6% underwent radiological vascular intervention. In majority of the patients (43%) etiology could not be identified (idiopathic) and 41 had some underlying hematologic problem, vascular problem in 13%. 28% patients expired.

Conclusions: There is high risk of ICH in patients with hematologic disorders. With complete workup etiology can be identified in most patients. High index of suspicion is required for early identification and management to prevent disability and mortality.

Keywords: Intracranial hemorrhage, Children, Spontaneous
PREVALENCE OF INTESTINAL PARASITES IN CHILDREN WITH DIARRHEA ADMITTED TO THE EMERGENCY DEPARTMENT

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Eskisehir Osmangazi University Medical Faculty, Turkey

Background/Purpose: Intestinal parasites are emerged as important causes of endemic or epidemic diarrheal disease in children. The aim of this study was to determine the prevalence of intestinal parasites in children with gastroenteritis living at Eskisehir/Turkey. A total of 578 fecal samples were collected at three years period in emergency departments of University and Government hospital with complaints of children with diarrhea.

Methods: Stool samples were processed following routine laboratory methods for diagnostic purposes. All stool samples were examined macroscopically and wet saline mounts and formalin-ethyl acetate sedimentation procedure. Initial identification of coccidian parasites was used Acid-fast staining method (ARB) of all samples.

Results: We investigated 578 diarrheal stool samples and 9.5 % were positive for one or more intestinal parasites. Respectively; 26 cases (4.5%), had clinically significant coccidian pathogenic organisms, while 29 (4.9%) specimens contained another parasites species one or mixed combination. We identified acid-fast stain to the intestinal coccidians. 26 patients (4.5%) were infected with coccidians, 13 of total cases (2.2%) with infected Microsporidia spp., 11 (1.9%) Cryptosporidium parvum, 1 (0.2%) with infected Cyclospora cayetanensis. There was no association of infection with any of the parasites with sex. As expected in our area was seen Giardia lamblia and Blastocystis hominis the most common pathogen with similar frequencies.

Conclusions: The coccidians and also other intestinal protozoons are important emerging pathogens in acute gastroenteritis. There is need of rapid and cost-effective methods for the determination of the causative agent.

Keywords: Intestinal parasites, Diarrhea, Children
SERUM ANION GAP AS A PROGNOSTIC FACTOR IN PEDIATRIC INTENSIVE CARE UNIT

Min Jung Kim, Yoon Hee Kim, In Suk Seol, Seo Hee Yoon, Soo Yeon Kim, Kyung Won Kim, Myung Hyun Sohn, Kyu-earn Kim

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Background/Purpose: It is crucial to predict the progress and prognosis in intensive care unit patients at their admission, but still unclear, especially in children. The aim of this study is to verify the predictive value of serum anion gap (AG) in Pediatric Intensive Care Unit (PICU).

Methods: We reviewed PICU patients and their initial biochemical data retrospectively. Serum AG compensated for abnormal albumin levels was compared with several PICU scoring systems and other biomarkers. The indicators of prognosis included length of stays (LOS) and mortality in PICU.

Results: Overall mortality was 31.8% (42/132) with 10 days of median LOS. The number of patients with metabolic acidosis was 72 (54.5%). The most common reason for admission to PICU was respiratory failure (46.2%). Corrected AG was significant lower in survivors than in nonsurvivors (P < 0.0001). And corrected AG was the only independent factor associated with in-hospital mortality after adjustment of sex, age, and concomitant conditions [OR 1.138, 95% CI 1.04-1.25, p=0.006] and well-correlated with other PICU scoring systems. The AUC for mortality prediction were 0.751 for corrected AG, 0.811 for PIM 2 score, 0.828 for PRISM III score, and 0.789 for PELOD score. The best cut-off value of corrected AG to predict mortality was calculated as 16.1mEq/L. At the cut-off of 16.1mEq/L, the AUC was 0.773 for mortality with 69.0% of sensitivity and 86% of specificity, while there was no difference in median LOS.

Conclusions: Corrected AG calculated at the admission was associated with mortality, regardless of the cause of admission, suggesting it could be used as a prognostic marker for critically ill children.

Keywords: Anion gap, Prognosis, Mortality
USEFULNESS OF PEDIATRIC INDEX OF MORTALITY 3 (PIM3)

In Suk Sol, Yoon Hee Kim, Soo Yeon Kim, Min Jung Kim, Seo Hee Yoon, Kyung Won Kim, Myung Hyun Sohn, Kyu-earn Kim

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Background/Purpose: Pediatric index of mortality (PIM) 3 score is updated with reclassification of diagnostic information based on PIM 2 used for predicting mortality of patients admitted to pediatric intensive care unit (PICU). The purpose of this study was to examine the usefulness of PIM 3 for children admitted to our unit and to investigate association of PIM 3 with the other factors of mortality prediction.

Methods: Our study enrolled 316 children admitted to PICU of the Severance hospital from January 2011 to March 2014. We investigated variables of PIM 2, Pediatric Risk of Mortality (PRISM) III and PIM 3 based on medical record retrospectively.

Results: The children were 3.4 years old and boys were 187 (59.2%). Eighty two (25.9%) children died and the mean PIM 3 score was 5.3% (1.8-16.2), while PIM 2 was 5.3% (2.0-9.2). PIM 3 showed best discrimination by receiver operating characteristic (ROC) with area under the curve (AUC) 0.833 (95 % CI; 0.778-0.889) followed by PRISM III with AUC 0.815 (95 % CI; 0.758-0.872) and PIM 2 with AUC 0.779 (95 % CI; 0.716-0.843). The variables of PIM 3 were analyzed using binary logistic regression model, of which, pupil response (hazard ratio [HR], 5.4) and risk group of diagnosis (HR, 4.9) were found to be significantly associated with mortality independently.

Conclusions: Our study showed that PIM 3 was more accurate for mortality prediction of patients in PICU than PIM 2 or PRISM III. The improved accuracy of PIM 3 was likely attributed to the very high risk group subdivided from the risk group of diagnosis in PIM 2.

Keywords: Mortality, Pediatric intensive care unit, Pediatric index of mortality
THE IMPACT OF AN INTENSIVIST ON THE CLINICAL OUTCOMES OF A PEDIATRIC INTENSIVE CARE UNIT

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²Department of Pediatrics, Samsung Medical Center, Sungkyunkwan University School of Medicine, Republic of Korea

Background/Purpose: Intensivists are thought to be important in improving mortality rates and the efficiency of bed utilization. Despite this, there is little data about the impact of pediatric intensivists. The aim of this study was to evaluate the effect of an intensivist on the clinical outcomes of patients in a pediatric intensive care unit (PICU).

Methods: We retrospectively compared the clinical outcomes of the pre-intensivist years (2010, 2011) and the intensivist years (2013, 2014). The PICU followed the open-ICU model during the pre-intensivist years and changed to a semi-closed-ICU model after the arrival of the intensivist. The primary outcome was the intensivists effect on severity adjusted PICU mortality, and the secondary outcomes were the length of PICU stay and the readmission rate. Severity was assessed by the pediatric index of mortality 3 score system.

Results: A total of 1,421 patients were included in this study: 725 in the pre-intensivist years and 696 in the intensivist years. The odds ratio of severity adjusted mortality of the intensivist years to the pre-intensivist years was 0.655 (confidence interval: 0.431 0.994). There was no significant difference in the length of PICU stay (3 vs 3 days, p = 0.327) or in the readmission rate (11.3% vs 9.3%; p = 0.257).

Conclusions: A pediatric intensivist in a semi-closed ICU may improve the severity adjusted mortality rate but may not affect the length of PICU stay or the readmission rate.

Keywords: Intensive care unit, Mortality, Length of stay, Child, Outcome assessment
THE ICU MANAGEMENT RATE OF SEVERE PEDIATRIC PATIENTS AT AICHI PREFECTURE IN JAPAN

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Background/Purpose: Intensive care unit (ICU), as well as pediatric ICU (PICU), could improve the management and prognosis of severe pediatric patients. However, PICU is not enough and is still under construction in Japan. In this condition, it is unclear where severe pediatric patients are treated.

Methods: This study was a population-based study in Aichi Prefecture, Japan. The population was 7,426 thousands, among which 1,065 thousands were less than 15 years old. A questionnaire was sent to 122 hospitals with the department of pediatrics. The number of ICU and PICU beds in the institute, the number of pediatric deaths less than 15 years old in 2014, and whether the dead patient had admitted to the ICU/PICU, were asked.

Results: The answers were sent back from 73 (59.8%) pediatrics-providing institutes. 179 beds in 26 general ICU, 0 beds in 0 PICU, and 156 beds in 16 NICU were included. Total number of pediatric death was reported 248 in Aichi Prefecture in 2014, whereas the answer included 180 (72.6%). ICU was not indicated for 73 for some reasons (e.g. because the death occurred in the outpatient or emergency department). 40 were treated in the ICU, but 61 did not admit to the ICU even though the institute had general ICU.

Conclusions: In Aichi Prefecture, shortage of PICU is a serious problem. Approximately 60% of dying pediatric patients was not treated even in general ICU. It had better be considered how severe pediatric patients get treated in coordination and cooperation with general ICU.

Keywords: ICU, PICU, Pediatric, Death, Aichi prefecture
MEASUREMENTS OF ROCURONIUM BROMIDE AS MARKER OF TRANSPLANTED LIVER FUNCTION

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\textsuperscript{1}Department of Anesthesia, Toronto General Hospital, University of Toronto, Canada, \textsuperscript{2}Department of Chemistry, University of Waterloo, Canada, \textsuperscript{3}Leslie Dan Faculty of Pharmacy, University of Toronto, Canada

Background/Purpose: Despite tremendous advancements in the management of liver transplantation (LT), there is no precise method to assess the function of transplanted organ. Transplant organs come from either live (LD) or deceased donors (DD). Our objective was to investigate whether pharmacokinetic (PK) of anesthesia drug routinely used during LT- Rocuronium (ROC) could serve as a marker evaluating the function of transplanted livers. ROC was chosen because it is metabolized mainly by the liver.

Methods: Following REB approval 22 consecutive patients scheduled for LT were recruited. Patients were divided into 2 groups: DD (n=13, 1500 g liver), and LD (n=9, 672 ± 89 g liver). Immediately prior to reperfusion of the transplant organ, all patients were given 0.6 mg·kg\textsuperscript{-1} of ROC. Blood samples for PK analysis were collected at pre-determined time points. The plasma concentrations of ROC were measured by solid phase micro-extraction (SPME)-based extraction and liquid chromatography mass spectroscopic analysis. PK analysis was conducted using ADAPT5 software.

Results: After bolus of ROC, biexponential decay profiles fit a two-compartmental model, revealed a significant difference in ROC clearance (CL). Patients from DD transplant group had a significantly lower CL (0.157±0.050 mL·min\textsuperscript{-1}·g\textsuperscript{-1} liver) compared to those from LD transplant group (0.265 ± 0.148 mL·min\textsuperscript{-1}·g\textsuperscript{-1} liver), values comparable to those (0.21-0.31 mL·min\textsuperscript{-1}·g\textsuperscript{-1} liver) in healthy subjects (Fig.1).

Conclusions: ROC CL was lower in DD than in LD transplant group which indicates differences in the metabolic capacity of the donor organ immediately after reperfusion. Differences in the ROC metabolism may be used to assess immediate liver function.

Keywords: Liver transplantation, Monitoring, Rocuronium bromide
CHARACTERISTICS AND OUTCOMES OF LONG STAY PATIENTS IN THE PEDIATRIC INTENSIVE CARE UNIT

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*Children’s Intensive Care Unit, KK Women’s and Children’s Hospital, Singapore*

**Background/Purpose:** Long-stay patients in pediatric intensive care units (PICUs) require an extensive amount of resources. We describe characteristics and risk factors for poor outcomes of long-stay patients (admitted for ≥14 days) in our PICU.

**Methods:** We reviewed medical records of all long-stay PICU patients from June 2009 to June 2014. Our primary outcome was PICU mortality. Secondary outcomes were nosocomial infections and complications (e.g., bedsores and deep vein thromboses). Wilcoxon rank-sum test and the chi-square test were used for analysis. Statistical analysis was taken as p < 0.05.

**Results:** There were a total of 241 long-stay admissions involving 211 patients. Median age at admission was 1.37 [Interquartile range (IQR) 0.27-6.35] years. Median length of stay was 22 (IQR 17-35) days. Overall PICU mortality was 48/211 (23%). Non-survivors had a higher median PRISM 2 score [15 (IQR 12-22) vs. 13 (IQR 8-20); p=0.03] and longer length of stay [27 (IQR 20-43) vs. 21 (IQR 17-33); p=0.02] than survivors. A significantly higher proportion of non survivors received cardiopulmonary resuscitation prior to PICU admission (15% vs 5%; p=0.02) and acquired blood stream nosocomial infection during their stay in the PICU (19% vs 7%; p=0.01). The use of PICU therapies [e.g., dialysis (31% vs 9%; p=<0.01) vasoactive infusion (77% vs 49%; p=<0.01) or extracorporeal membrane oxygenation (21% vs 3%; p=<0.01)] were associated with mortality.

**Conclusions:** Having a higher severity-of-illness score at presentation, need for cardiopulmonary resuscitation, acquired blood stream nosocomial infection or organ support therapies were associated with a higher mortality in long stay patients in the PICU.

**Keywords:** Long-stay patients, Pediatric intensive care unit, Length of stay
Table 1: Demographics of long stay PICU admissions (n=241)

<table>
<thead>
<tr>
<th>Variable</th>
<th>PICU survivors (n=193)</th>
<th>PICU non-survivors (n=48)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, median (interquartile range)</td>
<td>1.36 (0.21-5.98)</td>
<td>1.59 (0.37-8.65)</td>
<td>0.47</td>
</tr>
<tr>
<td>Male gender, n (%)</td>
<td>102 (53)</td>
<td>22 (46)</td>
<td>0.38</td>
</tr>
<tr>
<td>Emergency admission, n (%)</td>
<td>136 (70)</td>
<td>39 (81)</td>
<td>0.13</td>
</tr>
<tr>
<td>Gestational age &lt; 37 weeks, n (%)</td>
<td>34 (18)</td>
<td>13 (27)</td>
<td>0.12</td>
</tr>
<tr>
<td>Pre-existing chronic care devices, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastrostomy tube</td>
<td>17 (9)</td>
<td>3 (6)</td>
<td>0.56</td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>79 (41)</td>
<td>11 (23)</td>
<td>0.02</td>
</tr>
<tr>
<td>Chronic ventilation</td>
<td>85 (34)</td>
<td>11 (23)</td>
<td>0.15</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>7 (4)</td>
<td>1 (2)</td>
<td>0.59</td>
</tr>
<tr>
<td>TPN dependent</td>
<td>4 (2)</td>
<td>2 (4)</td>
<td>0.41</td>
</tr>
<tr>
<td>Indications for admission, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>93 (48)</td>
<td>21 (44)</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>40 (21)</td>
<td>20 (42)</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>8 (4)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Neurological</td>
<td>43 (22)</td>
<td>5 (10)</td>
<td>0.07</td>
</tr>
<tr>
<td>Trauma</td>
<td>2 (1)</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Metabolic</td>
<td>3 (1.6)</td>
<td>1 (2)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Secondary outcomes in PICU long-stayers

<table>
<thead>
<tr>
<th>Clinical outcomes</th>
<th>PICU survivors (n=193)</th>
<th>PICU non-survivors (n=48)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication from PICU stay, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal (e.g., colitis)</td>
<td>10 (5)</td>
<td>2 (4)</td>
<td>0.77</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>19 (10)</td>
<td>6 (13)</td>
<td>0.59</td>
</tr>
<tr>
<td>Bed sore</td>
<td>8 (4)</td>
<td>4 (8)</td>
<td>0.23</td>
</tr>
<tr>
<td>Nosocomial infection, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td>93 (48)</td>
<td>19 (40)</td>
<td></td>
</tr>
<tr>
<td>1-2 infections</td>
<td>87 (45)</td>
<td>28 (58)</td>
<td>0.18</td>
</tr>
<tr>
<td>≥ 3 infections</td>
<td>13 (7)</td>
<td>1 (2)</td>
<td></td>
</tr>
<tr>
<td>Urinary tract infections</td>
<td>27 (14)</td>
<td>8 (17)</td>
<td>0.64</td>
</tr>
<tr>
<td>Ventilator associated pneumonia</td>
<td>77 (40)</td>
<td>27 (56)</td>
<td>0.04</td>
</tr>
<tr>
<td>Blood stream infections</td>
<td>13 (7)</td>
<td>9 (19)</td>
<td>0.01</td>
</tr>
<tr>
<td>Surgical site infections</td>
<td>5 (3)</td>
<td>0 (0)</td>
<td>0.26</td>
</tr>
</tbody>
</table>
FREQUENCY, PATTERN AND OUTCOME OF SEVERE INJURIES IN CHILDREN FROM PICU OF A RESOURCE-LIMITED COUNTRY

Qalab Abbas, Anwar Ul Haq
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Background/Purpose: Pediatric trauma is a major cause of PICU admissions putting great burden on resource constrained countries. Little is known about epidemiology of pediatric trauma in PICU, resource utilization and outcome. We report our experience of pediatric trauma at our center.

Methods: Retrospective review of medical records of children (1 mo - 18 years) admitted in PICU (a closed, multidisciplinary-cardiothoracic) between Jan 2009-Dec 2014 with diagnosis of injury was done after approval from ethical review committee. Data collected included age, gender, category and mechanism of injury, type of trauma, body region affected, place of injury, presentation, initial baseline laboratory workup, intervention done in the ER and PICU, and outcome. Results are presented as frequency/ percentages and mean ± SD.

Results: Total 103 patients (8% of total PICU admissions) were admitted with the diagnosis of injury, 67% were males with mean age 89 ± 56 months. Trauma was the major category (88%) with road traffic accidents (RTA) comprising 37% and fall 29%. 8% patients had poisoning, 76% blunt trauma and 66% had single body region involvement, head being involved in 48%. 78% of the injuries were witnessed. Coma was the main presentation in 36% children, respiratory problem in 21%, 67% were intubated in ER, CPR was done in 1 patient, 83.5% patients needed mechanical ventilation, surgical intervention was done 64% of patients. PICU length of stay was 6 ± 3 days and 20% patients expired.

Conclusions: Injury resulting from RTA is a leading cause of PICU resource utilization and carries high mortality. Prevention can be the best way to reduce this.

Keywords: Severe injury, Children, PICU
COMPARISON OF INTRAORAL MOISTURE LEVELS AMONG THREE OXYGEN THERAPY DEVICES: A HIGH FLOW SYSTEM, A SIMPLE FACE MASK, AND A NASAL CANNULA

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Background/Purpose: The purpose of this study is to investigate intraoral moisture levels using a high flow system (NHF), a simple face mask and a nasal cannula. Three groups were compared.

Methods: 31 subjects were enrolled from ICU in this study. Their ICU stay was for 48-72 hours. We divided them into three groups. Group 1 included ten subjects who used a NHF system with a heated humidifier. Group 2 included six subjects who used a simple face mask with an unheated humidifier, and Group 3 included 15 subjects who used a nasal cannula without a humidifier. The subjects' intraoral moisture levels were assessed by utilizing an intraoral moisture checker called MUCUS® and scores of the Revised Oral Assessment Guide (ROAG). The intraoral moisture levels were checked both a few minutes after and 48-72 hours after using oxygen therapy devices. These levels and scores were compared among the three groups. Statistical analyses were performed using Chi-square test, Kruskal-Wallis test, and Mann-Whitney test with Bonferroni correction.

Results: Significant differences were found between Group 1 (NHF subjects) and Group 2 (simple face mask subjects) (P < 0.004), and between Group 1 and Group 3 (nasal cannula subjects) (P < 0.043) in intraoral moisture levels. No significant difference was found between Group 2 and Group 3 in intraoral moisture levels. No significant difference in the ROAG scores was found among the 3 groups.

Conclusions: We concluded that a NHF (oxygen delivery) system maintained more optimum intraoral moisture than a simple face mask and a nasal cannula.

Keywords: NHF, Intraoral moisture levels
APPLICATION OF THE BERLIN DEFINITION IN CHILDREN WITH ACUTE RESPIRATORY DISTRESS SYNDROME

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Yonsei University College of Medicine, Republic of Korea

Background/Purpose: A newly revised Berlin definition (BD) showed better predictive validity for mortality in adults with acute respiratory distress syndrome (ARDS), but has not been explored in children. We sought to examine the validity of the BD for pediatric ARDS compared to the American-European Consensus Conference definition (AECCD).

Methods: This single center, retrospective study included 127 patients aged from 1 month to 19 years, admitted to pediatric intensive care unit due to acute lung injury (ALI, n=31) or ARDS (n=96) with the AECCD. All patients characteristics and mortality rates were compared among subgroups according to the BD and the AECCD.

Results: Sixty four patients (50%) died. Mortality rates were significantly different across subgroups of both definitions (25.8% in mild, 41.7% in moderate, 75% in severe by the BD; P < 0.001, 25.8% in ALI, 58.3% in ARDS by the AECCD; P = 0.024). The BD had better prediction for mortality with AUC of 0.656 (95% CI, 0.519-0.718) than the AECCD with AUC of 0.562 (0.515-0.606). Pediatric Risk of Mortality (PRISM) III and Pediatric Index of Mortality (PIM) 3 scores also showed significant difference across subgroups of the BD, while only PRISM III score did between subgroups of the AECCD. Regarding biomarkers of disease severity, delta neutrophil and lactate showed significant difference across subgroups of the BD, while only lactate did between subgroups of the AECCD.

Conclusions: The BD adopted a severity classification and could show the mortality prediction better than the AECCD also in pediatric ARDS.

Keywords: Acute respiratory distress syndrome, Berlin definition, Children
ZERO VENTILATOR ASSOCIATED-PNEUMONIA AFTER IMPLEMENTATION OF BUNDLE-CARE

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Background/Purpose: Ventilator associated pneumonia (VAP) is the second most common hospital-acquired infection, is associated with high morbidity, mortality and attributable to high cost for patients in pediatric intensive care unit (PICU). Prevention is the most appropriate intervention.

Methods: To assess the rate of VAP after implementation of VAP-prevention bundle care in a closed multidisciplinary PICU of a resource-limited country.

Results: All children who admitted in PICU from April 2011 to March 2012 were prospectively enrolled. A multidisciplinary-team was formed, educated, who implemented a pediatric VAP-prevention bundle checklist during daily rounds. The diagnostic criteria, surveillance methods and VAP-bundle care were used as described by the Center for Disease Control and Prevention / National Nosocomial Infection Surveillance (CDC/NNIS). Key elements of pediatric VAP-prevention bundle included: Head-up 20-30°, mouth-care with chlorhexidine, clean suction practices, sedation vacation daily and daily assessment of readiness for extubation. Demographic data and clinical variables were recorded. The primary outcome was the rate of VAP during the study period.

Conclusions: A total of 115 patients (33.72%) were enrolled. The mean age was 4.02 ± 4.29 yo and 36.7% (35) were infants. 69% (62) were male. The indications of MV were respiratory illness (54%), neurological illness (31%), shock (9%) and postoperative care (6%). The mean duration of MV was 7.05 ± 5.4 days. There were 907 ventilator-days during study period. No subject developed VAP in our cohort.

Keywords: Ventilator associated pneumonia, Pediatric intensive care unit
COMPARISON BETWEEN TWO TYPES OF OXYGEN MASKS FOR LOW FLOW OXYGEN THERAPY

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¹Department of Clinical Engineering, Yamagata University Hospital, Japan, ²Department of Anesthesiology, Yamagata University Hospital, Japan

Background/Purpose: To compare the effect of two oxygen masks on fractions of inspired oxygen (FiO₂) and inspiratory carbon dioxide concentration (FiCO₂).

Methods: The simple oxygen mask (S mask; Atom Medical, Japan) and the open oxygen mask (O mask; Atom Medical, Japan) were evaluated for comparison. We used a human lung simulator LUNGOO (C:60, R: 5, F:20), a mannequin made to simulate the respiratory tract (the nose, mouth, and the trachea), carbon dioxide gas from a cylinder to the LUNGOO and kept EtCO₂ at 40mmHg. Each parameter of the oxygen flow settings from 0 LPM through 10 LPM was measured at the nasal cavity, mouth, and the trachea using the Capnostream 20P and the VT305 gas flow analyzer, tidal volume 250ml and 500ml.

Results: The O mask presented higher FiO₂ statistics than the S mask at all measurement points. The FiO₂ presented highest in the mouth, followed by trachea and nose. However, the S mask presented higher FiCO₂ than O mask. The O mask produced less FiCO₂ even during low oxygen flow. The smaller tidal volume was the higher FiO₂ and lower FiCO₂ in both O mask and S mask. O mask has special shape that the gas flows into the oral and nasal cavities and large holes at the side of the mask. It can administer the oxygen efficiently to a patient, has decreased the risk of CO₂ re-breathing and might decrease the inspiratory resistance.

Conclusions: O mask can deliver higher FiO₂ and better prevents CO₂ re-breathing in comparison to S mask.

Keywords: Oxygen masks, FiO₂, FiCO₂, CO₂ re-breathing
MODERN MECHANICAL VENTILATOR CAN DELIVER ACCURATE AMOUNT OF GAS IN NEONATAL LUNG MODEL: A LUNG SIMULATOR STUDY

Yoshikazu Yamaguchi, Tetsuya Miyashita, Masasumi Idei, Tasuku Yoshida, Makoto Sasaki, Yuko Matsuda, Shunsuke Takaki, Masashi Shioda, Kenji Mizutani, Osamu Yamaguchi, Takahisa Goto

Yokohama-City University, Department of Anesthesiology and Critical Care, Japan

Background/Purpose: The objective of this study is to determine whether anesthetic machine and mechanical ventilator could deliver accurate amount of gas in neonatal lung model.

Methods: Anesthetic machine (Fabius GS, Drager) and two mechanical ventilators (Servo i Maquet and Infinity V500, Drager) were evaluated. These ventilators were connected to lung simulator (ASL5000, Ingmar medical) through a disposable ventilator circuit. Three lung models were set: resistance (cmH2O/L/sec) and compliance (mL/cmH2O) were 50, 2 (Group1), 100, 1 (Group2) and 150, 0.5 (Group3) respectively. Each ventilator was evaluated with tidal volume 30mL respiratory rate 25/min, PEEP 3cmH2O, inspiratory time 0.6 sec, using VCV and DCV. Ventilator-displayed tidal volume and actual-tidal volume (ASL500 measured) were recorded.

Results: The results are shown in Table.

Conclusions: There were significant difference between anesthesia machine-displayed tidal volume and actual-delivered tidal volume. Modern ventilator could deliver accurate amount of gas.

Keywords: Mechanical ventilation, Neonate, Simulation

<table>
<thead>
<tr>
<th>Ventilator</th>
<th>Mode</th>
<th>Group 1 Mean±SD (mL)</th>
<th>Group 2 Mean±SD (mL)</th>
<th>Group 3 Mean±SD (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabius GS</td>
<td>VCV</td>
<td>Actual tidal volume</td>
<td>26.6±0.56</td>
<td>26.7±0.18</td>
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<tr>
<td></td>
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<td>Displayed-tidal volume</td>
<td>23.0±0.58</td>
<td>15.6±0.90</td>
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<tr>
<td>Infinity V500</td>
<td>VCV</td>
<td>Actual tidal volume</td>
<td>30.2±0.13</td>
<td>30.1±0.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Displayed-tidal volume</td>
<td>30.0±0.00</td>
<td>30.0±0.00</td>
</tr>
<tr>
<td>Infinity V500</td>
<td>DCV</td>
<td>Actual tidal volume</td>
<td>30.6±0.18</td>
<td>30.9±0.18</td>
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<td></td>
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<td>Displayed-tidal volume</td>
<td>30.0±0.00</td>
<td>30.0±0.00</td>
</tr>
<tr>
<td>Servo i</td>
<td>VCV</td>
<td>Actual tidal volume</td>
<td>31.4±0.12</td>
<td>30.1±0.13</td>
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<td></td>
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<td>Displayed-tidal volume</td>
<td>29.4±0.53</td>
<td>27.7±0.49</td>
</tr>
<tr>
<td>Servo i</td>
<td>DCV</td>
<td>Actual tidal volume</td>
<td>30.1±0.17</td>
<td>28.5±0.24</td>
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<td></td>
<td></td>
<td>Displayed-tidal volume</td>
<td>26.6±0.53</td>
<td>24.9±0.38</td>
</tr>
</tbody>
</table>

* p<0.05
** p<0.0001
SIGNIFICANCE OF ELECTROLYTE DISORDERS IN PEDIATRIC INTENSIVE CARE UNIT PATIENTS

Poonam Thakore, Sudip Sheth, Tetyana Vasylyeva, Eric Levy

Department of Pediatrics, Texas Tech Health Sciences Center, United States

Background/Purpose: The main objective is to determine the prevalence of common electrolyte disorders on admission in Pediatric Intensive Care Unit (PICU) patients and to evaluate the difference in length of stay (LOS) for patients with and without electrolyte abnormalities.

Methods: A retrospective chart review of patients admitted in the PICU of North West Texas Children Hospital, Amarillo, TX from January, 2012 to December, 2012 was conducted after IRB approval. Patients with asthma exacerbation, bronchiolitis and surgery/trauma were included. Age, sex, primary diagnosis, serum chemistries on admission and Length of stay were recorded. Electrolyte abnormalities were defined as: Hyponatremia if serum sodium <135 mEq/L, hypokalemia if serum potassium < 3.5 mEq/L and metabolic acidosis if serum bicarbonate < 22 mEq/L. Unpaired two tailed t-test with p <0.05 was used.

Results: A total of 77 patient charts were reviewed. Mean values of abnormal electrolytes on admission: hyponatremia 132 ± 0.9 mEq/L, hypokalemia 3.1 ± 0.06 mEq/L and metabolic acidosis 20 ± 0.2 mEq/L. Fifty-five (71.42%) patients had at least one electrolyte abnormality. Prevalence of hyponatremia (15.58%) and metabolic acidosis (36.36%) was significantly (p<0.05) associated with all acute illnesses, which led to PICU admissions. Prevalence of hypokalemia (19.48%) was significantly (p<0.05) associated with all diagnosis groups except bronchiolitis. The mean duration of hospital stay in all study patients with hyponatremia was significantly higher (p=0.01) as compared to patients with normal serum sodium level.

Conclusions: The prevalence of electrolyte abnormalities on admission in PICU patients is 71.42%. Hyponatremia is an independent risk factor associated with prolonged hospital stay in PICU.

Keywords: Hyponatremia, Hypokalemia, Metabolic acidosis
A PROSPECTIVE STUDY OF CRITICAL INCIDENT REPORTING IN AN INDIAN PEDIATRIC INTENSIVE CARE UNIT

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Post Graduate Institute of Medical Education & Research, India

Background/Purpose: Critical incident represent a significant threat to patient safety leading to increased morbidity and mortality. Data on critical incidents from resource limited countries is scare. The objectives of our study were to describe the incidence and outcome of critical incident in PICU.

Methods: All children, 2 months - 12 years old, admitted in PICU from Jan - Dec 2013 were enrolled. Critical incident was reported by any of the doctors, nurses or parents in PICU on a predesigned proforma. Data collected included details of incident, its severity and effect on patients. Factors (human, equipment, environmental and practice related) contributing to critical incidents and its complications were analyzed.

Results: 449 critical incidents were reported among 789 patients admitted during the study period; incidence being 8.2/100 patient-days. The incidents were related to medication (104, 23.2%), ventilation (89, 19.8%) and fluid and electrolytes (51, 11.3%). Only 1 incident was catastrophic due to tube block; 32 (7.1%) were major; 108 (24.1%) were insignificant and 160 (33.6%) were minor in severity. Common complications following the incidents were transient hypoxemia 55 (10.7%) (SpO2 < 92% for < 1 min), shock 51 (9.9%) and extravasation injury 36 (7%). Four hundred sixteen (92.7%) incidents were detected within 24 hours. Human-factor (428, 56.5%) and practice-related-factors (297, 39.2%) were main reasons for incidents.

Conclusions: Critical incident are not uncommon in PICU. Most factors are preventable as are due to human and system errors. Continuous training of medical professional and adherence to protocols is needed to decrease these incidents.

Keywords: Critical incidents, Resource limited countries, Pediatric intensive care unit
INVESTIGATION OF SEROLOGICAL RESULTS OF TOXOPLASMA GONDII ANTIBODIES AMONG CHILDREN REFERRED TO MEDICAL FACULTY HOSPITAL DURING FIVE YEARS IN TURKEY

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Background/Purpose: The epidemiological factor of Toxoplasma gondii is known to depend on a number of behavioral factors, including contact with animals and eating habits. Parasites can also be more common in certain groups. Infection in humans is usually asymptomatic; but may cause a life threatening complications among pregnant women and neonates. The aim of this study is to determine the serological results of pediatric patients with suspected toxoplasmosis who were admitted to the Parasitology Laboratory of Osmangazi University Hospital in Eskisehir between 2010 and 2015 years. We conducted this study Toxoplasma gondii seroprevalence among children of both sexes the fact that will help to understand its epidemiology and implement control measures of this parasite infection among this group.

Methods: This retrospective study included 1,025 children (559 male, 466 female) referred to Eskishehir Osmangazi University Hospital between 2010-2015. Toxoplasma gondii IgG and IgM antibodies were determined in serum specimens by ELISA. The samples were analyzed using VIDAS (BioMérieux, France). IgG avidity tests were also performed in cases with both IgG and IgM seropositivity.

Results: The five year total seroprevalence of anti-Toxoplasma gondii IgG, IgM antibodies among males was 34.8% (range between 5.8-9.6%), 7.8% (range between 0-5.7%) respectively. While for females, the seroprevalence of IgG, IgM antibodies was 42.3% range between 5.9-12.5%), 5.2% (range between 0- 4.3%) respectively in the same period. The five year toxoplasma IgM seropositivity showed significant (p < 0.05) among male group but Toxoplasma IgM seropositivity was not significant among females during these five years. No significance in Toxoplasma IgG seropositivity was seen among both sexes. Decrease in the prevalence of anti-T. gondii IgG seropositivity in 2012 was found to be statistically significant considering the five years period (p < 0.001).

Conclusions: Analyzing the toxoplasma seropositivity provides helpful information for epidemiologic and control aspects; besides, these data would be useful for future monitoring of prevalence of this disease among children.

Keywords: Toxoplasma gondii, Serology, Children
INCIDENCES AND INFLUENCES OF DEVICE-ASSOCIATED, HEALTH CARE-ASSOCIATED INFECTIONS IN A PEDIATRIC INTENSIVE CARE UNIT IN JAPAN: A RETROSPECTIVE SURVEILLANCE STUDY

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Background/Purpose: Device-associated, health care-associated infections (DA-HAIs) are a major problem in PICU. There are no data available about incidences of DA-HAIs and their influences on length of PICU stay and mortality in PICU in Japan. The purpose of this study was to investigate the incidences of three common DA-HAIs and their influences on length of PICU stay and mortality in a PICU in Japan.

Methods: We conducted a retrospective surveillance study in a single PICU in Japan during 12 months. Firstly, we investigated the incidences of three common DA-HAIs: central line-associated bloodstream infections (CLA-BSI), ventilator associated pneumonia (VAP) and catheter associated urinary tract infection (CAUTI) according to the CDC/NHSN surveillance definitions. Secondary, we compared patients’ characteristics, morbidity and mortality between the groups of patients with and without DA-HAIs.

Results: Of all 426 admitted patients, 28 patients (6.6%) acquired DA-HAIs. Incidence of all DA-HAIs per 1,000 patient-days was 11.2. Incidences of DA-HAIs (CLA-BSI, VAP and CAUTI) per 1,000 device-days were 4.3, 3.5 and 13.6 respectively. Median length of PICU stay of the patients with DA-HAIs was 22.5 days and that without DA-HAIs was 2 days. Actual mortality of patients with DA-HAIs was 7.1% which was worse than predicted mortality of 6.3%, while actual mortality of patients without DA-HAIs was 2.3% which was better than predicted mortality of 3.5%.

Conclusions: This study showed the incidences and influences of common DA-HAIs in a PICU in Japan. DA-HAIs seem to be associated with longer length of PICU stay and higher mortality rate.

Keywords: Device-associated, Health care-associated infection, Nosocomial, Infection, PICU, Japan
TROPICAL FEVERS IN PICU: A MULTI-CENTRE PROSPECTIVE OBSERVATIONAL STUDY

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1Postgraduate Institute of Medical Education and Research, India, 2Jeevanrekha Critical Care and Trauma Hospital, India, 3PGIMS, India, 4Christian Medical College, India, 5JLN Medical College, India, 6Apex Hospital, India, 7Indian Society of Critical Care Medicine (ISCCM), India

Background/Purpose: Infections in tropics pose unique challenges as they often present with organ failures. We conducted this study to identify the clinical profile, etiology, PICU resource utilization and outcome of tropical fevers in India.

Methods: This was a multicentre prospective observational study done in 7 PICUs between July 2013 and June 2014. Critically ill children < 18 years with non-localizing fever of > 48 hours and onset < 14 days with any of the following: thrombocytopenia, respiratory distress/ARDS, jaundice, encephalopathy, renal failure or multi organ failure were enrolled consecutively.

Results: Among 173 children enrolled, thrombocytopenia was the commonest presentation (60%) followed by respiratory distress (45%), encephalopathy (29%), multi organ failure (11%). Etiology could be established in 143 (82%) children. Encephalitis/meningitis accounted for 21% (n=37) cases. Dengue (n=33, 19%), scrub typhus (n=30, 17%), sepsis (n=14, 8%) and malaria (n=8, 5%) were other major diagnoses. Hemoglobin ≥ 11g/dl was independently associated with dengue while thrombocytopenia and respiratory distress/ARDS were associated with scrub typhus. Glasgow Coma Score < 10 was associated with encephalitis/meningitis. 36% (n=63) received mechanical ventilation. Vaso-active agents were used in 24% (n=42). Nine (5%) required renal replacement therapy. Ceftriaxone(66%), doxycycline (37%), acyclovir(23%) and artesunate (10%) were the common antimicrobials used. At 28 days, 80% survived without disability, 5% had some disability, 15% died. Mortality was three times higher (33% vs 11%) in children without a specific diagnosis.

Conclusions: Our findings support ISCCMs tropical fevers management guidelines, which envisage a syndromic approach to management, comprising point of care diagnostic tests for dengue, malaria and typhoid, and initial empiric treatment with ceftriaxone and doxycycline and acyclovir in addition for children with encephalopathy.

Keywords: Tropical fevers, Children, PICU, Scrub typhus
RETROSPECTIVE AUDIT OF ANTIBIOTIC USE IN PICU OF A DEVELOPING COUNTRY

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Background/Purpose: Pediatric Intensive Care Units (PICU) having a separate population with distinctly variable underlying disease processes and unique microbiology. Data regarding the use of antibiotics in Pediatric ICU (PICU) in developing countries is scarce, knowing this can help to reduce unnecessary antibiotic use.

Methods: Retrospective review of medical records of all children (age 1 mo to 16 years) admitted in our closed multidisciplinary-cardiothoracic PICU from January to June 2013 was done after approval from ethical review committee. For each antimicrobial, indication (prophylactic, empiric, therapeutic) and duration of use were recorded. All diagnosis of infections were recorded according to the diagnostic criteria of IPSCC 2005. Results are presented as frequency with percentages and median with IQR.

Results: Out of total 240 patients admitted in PICU during the study period 100% received antibiotics, 43% (n=104) as prophylaxis after surgery most commonly cephazolin, 40% (n=96) empirically, most commonly ceftriaxone and 17% (n=40) therapeutically. Median number of antibiotic use in PICU was 3 with range of 1-7, 24% received 1 agent, 24% received 2 agents, 32% received 3 agents and 11% received ≥ 4. Majority 76% (n=182) received combination therapy with 2 or more antibiotics. Most frequently used combination was meropenem and vancomycin. 30 blood culture (12.5%) and 6 tracheal cultures (2.5%) were positive for microorganisms and multi drug resistance organisms were found in 8% (n=17) of the patients, majority in blood CS.

Conclusions: There is a widespread unrestricted antibiotics prescription practice, which can lead to spread of more resistant organism.

Keywords: Antibiotic use, PICU, Audit
TOXIC EPIDERMAL NECROLYSIS-7 YEARS EXPERIENCE IN A LEVEL III PICU IN INDIA

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Background/Purpose: Literature on clinical profile, course and outcome of toxic epidermal necrolysis (TEN) is lacking, especially in Indian children. We report our experience of TEN of last 7 years.

Methods: All children (1 months - 12 years) having TEN, admitted to PICU were included. Retrospective chart review of all cases was done from case records. Demographic, clinical profile, complication and outcome were recorded in a predesign performa. SPSS 21 was used for descriptive statistics.

Results: Among 31 children, 20 were male; mean (± SD) age was 6.2 (± 2.7) years. Median (IQR) duration of illness and rash were 7 (5, 10) and 4 (3, 7) days respectively. Fever was present in 27 (87.1%) children. Drugs were precipitating factors in all; antiepileptics (45.2%) being the commonest. Mean (± SD) body surface area involved at admission was 61.3 ± 26.4 %. Median (IQR) PRISM III was 13 (10, 16). Intravenous immunoglobulin was given in 22, steroids in 9 and both in 2 children. Complications observed were respiratory failure 11 (35.5%), DIC 7 (22.6%), shock 6 (19.4%) and AKI 5 (16.1%). Nineteen (61.3%) children developed sepsis; Staphylococcus aureus was the commonest organism. Twenty-five (80.6%) children survived, 4 (12.9%) died and 2 went against medical advice. Median (IQR) duration of PICU stay was 8 (5, 12) days. All survivors were followed up for 1 year (Table no 1). One child died due to non-resolving bronchiolitis obliterans.

Conclusions: TEN treated in PICU has a good prognosis. Immunomodulation therapy may play an important role. Long-term outcome is good with no or minor sequelae.

Keywords: Toxic epidermal necrolysis, Intravenous immunoglobulin, Outcome, Indian children

Table no 1: Clinical Features on Follow-Up

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<td>25</td>
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<td>Redness eyes and discharge</td>
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<td>Urination/ defecation problem</td>
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*Rest 6 children have to complete 12 month follow up
THE INCIDENCE OF DENGUE SHOCK SYNDROME (DSS) AMONG CHILDREN AT WANGAYA HOSPITAL, DENPASAR CITY, BALI PROVINCE

Muhammad Faisal Putro Utomo, Anindia Reina Yolanda, Pande Mirah Dwi Anggreni, Made Ayu Widyaningsih, I Nyoman Sutarsa
Medical Faculty of Udayana University, Indonesia

Background/Purpose: Dengue Fever (DF) is one of public health threats in Indonesia causing several deaths and financial loss. A serious complication of DF which can lead to death is DSS, mainly occurred among infants and children. Even though the incidence study of DSS among adults has been documented, the incidence of DSS among children is rarely conducted.

Methods: A descriptive study with a total sample of 95 children were conducted. All children diagnosed to have DF between January-December 2014 admitted to Wangaya Hospital were included in the study. Data were collected by extracting information from the medical records including demographic characteristic, final diagnosis, and results of complete blood count test. Data were analyzed using univariate approach.

Results: From a total of 95 cases, 54.7% were males and 8.4% progressed to DSS (4 boys and 4 girls). All DSS cases were aged ≤10 years old. The incidence of DSS among children in Denpasar City was 84.21 per 1,000 children. The incidence of DSS was found to be higher among girls than boys (93.02 vs 76.9). Laboratory findings associated to progression of DF among children are: initial thrombocyte count (46.88 ± 17.61); hemoglobin level (14.6 ± 2.02) and initial hematocrit count (43.76 ± 3.89).

Conclusions: Children with DF aged under 10 years are more vulnerable to develop DSS. The risk of DSS is increasing among girls, showing low level of initial thrombocyte count and when signs of plasma leakage found. Early admission to hospital may reduce the risk of developing DSS thus will prevent associated deaths.

Keywords: Dengue fever, Dengue shock syndrome, Children, Incidence, Denpasar
ACUTE PULMONARY EDEMA DURING PREGNANCY: A CASE STUDY

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Introduction: Pulmonary edema during pregnancy is a significant cause of morbidity potentially threatening the mothers’ life. In this case we present an acute pulmonary edema in a hypotensive pregnant patient and discuss the potential causes of edema.

Case: A twenty year old primipara, in the 21 weeks of pregnancy, complained of headache, fever and abdominal pain. After admission to ICU, her vital signs were heart rate: 120/min, blood pressure: 98/36 mmHg, temperature: 38.7 °C, respiratory rate: 33/min, SpO2: 82%, respectively. Fluid resuscitation, 3 l/min flow of oxygen and broad spectrum antibiotics were applied to the patient, initially. CRP was 123 mg/dL and procalcitonin was 7.2 ng/ml. After 16 hours of admission, abundant pink foamy sputum was observed and patient was treated with diuretics for pulmonary edema. Chest X-ray revealed extensive bilateral consolidation consistent with pulmonary edema and diuretic was administered. The patient was intubated electively due to worsening hypoxemia. Transthoracic echocardiogram and cardiologist’s review showed normal left ventricular function with no other valvular heart disease or cardiomyopathy. Abdomino-pelvic ultrasonography revealed no pathological findings. Patient had vaginal bleeding and amniotic fluid discharge leading to spontaneously abortion of a stillborn fetus. On the basis of PCT value of 7.2 ng/mL, meropenem, anidulofungin, teicoplanine and oseltamivir was included for the antibiotic treatment. There were no positive results from blood, urine, endotracheal aspirate and vaginal swab culture. The patient’s lung had been progressively improved and extubation was done around 72 hours from intubation.

Conclusions: Sepsis during pregnancy can be a very challengeable clinical problem to manage and excessive fluid application may lead to life threatening pulmonary edema.

Keywords: Acute pulmonary edema, Pregnancy, Sepsis
INHALED ISOFLURANE FOR LIFE THREATENING BRONCHOSPASM

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Introduction: The series of case reports have suggested that inhaled isoflurane could be life saving for refractory life-threatening status asthmaticus. We here present our experiences of two pediatric cases with different responses to isoflurane therapy.

Case: Patient 1, a 1-year-old boy with duplication 2p syndrome, was admitted with a 1-day of fever and dyspnea and developed status asthmaticus. He became refractory to albuterol and ipratropium bromide, intravenous corticosteroids and aminophylline, and deteriorated rapidly requiring mechanical ventilation. Isoflurane was started and titrated to an end-expiratory concentration of 1% on the next day because his arterial blood CO₂ was progressively worsening. After two and a half hours of isoflurane, his respiratory acidosis with hypercapnia was dramatically resolved and weaned successfully. Patient 2, a 5-year-old girl with bronchiolitis obliterans after allogeneic peripheral stem cell transplantation, was admitted after a 1-day of cough and dyspnea. She developed severe bronchospasm and her hypercapnia and high peak airway pressure were not improved. Isoflurane was titrated at an end-expiratory concentration of 1.5%. However, isoflurane was stopped due to rapid increase of PaCO₂ from 69 to 139 mmHg within 1 hour. She was eventually placed on an extracorporeal membrane oxygenation.

Conclusions: Inhalation isoflurane could be life saving for those with refractory bronchospasm, but should be used carefully.

Keywords: Bronchospasm, Inhaled anesthetics, Isoflurane
EXTRACORPOREAL MEMBRANE OXYGENATION IN PEDIATRIC PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME AND INTRA-ABDOMINAL BLEEDING REQUIRING SURGERY

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Introduction: Extracorporeal membrane oxygenation (ECMO) can be used for patients with acute respiratory failure until the pulmonary function gets recovered. ECMO therapy has traditionally been contraindicated in patients with severe bleeding tendencies because it requires a systemic anticoagulant. However, we would like to introduce the case of a pediatric patient with acute respiratory distress syndrome and severe intra-abdominal bleeding requiring surgery.

Case: A five-year-old girl who fell from a fifteenth floor apartment was referred to the emergency department. A primary chest computed tomography (CT) showed bilateral pulmonary contusion and pneumothorax. An abdominal CT showed multiple lacerations in the liver and spleen, renal contusion, adrenal hemorrhage, and hemoperitoneum. The bleeding was not controlled and the patient showed abdominal compartment syndrome and oxygenation failure, in spite of mechanical ventilation. We performed damage control surgery and ECMO insertion simultaneously. The patient’s abdominal wall was opened for four days for intra-abdominal decompression. During ECMO therapy, heparin was titrated according to the bleeding condition of the patient. ECMO therapy was applied for eighteen days and the mechanical ventilator for twenty-one days, after which the patient was able to breathe without respiratory distress and was discharged on foot.

Conclusions: ECMO therapy can be another therapeutic choice for respiratory failure with severe hemorrhage which requires surgical treatment.

Keywords: Extracorporeal membrane oxygenation, Trauma, Pediatric, Hemorrhage, Respiratory failure
A MORTALITY OF 11 MONTHS INFANT DUE TO DENGUE SHOCK SYNDROME (DSS) AT WANGAYA HOSPITAL, DENPASAR CITY, BALI PROVINCE

Anindia Reina Yolanda, Pande Mirah Dwi Anggren, Muhammad Faisal Putro Utomo, Made Ayu Widyaningsih, I Nyoman Sutarsa

Medical Faculty of Udayana University, Indonesia

Introduction: Dengue Hemorrhagic Fever (DHF) may progress to Dengue Shock Syndrome (DSS) depending on several factors, such as age, thrombocytopenia, plasma leakage, and prolonged fever. Without proper medications, patients may reach critical stage between 3 to 6 days after the onset of symptoms. Children have the highest risk in developing DSS. Unfortunately, there was no specific signs and symptoms for DHF thus leads to late admission. This condition will increase the mortality risk of DHF patients.

Case: We report a case of 11-month-old infant suffered from DSS. Upon admission, the patient had suffered from fever for 5 days. The initial physical examinations showed hypothermia, hepatomegaly, gastrointestinal bleeding, and somnolence. The initial complete blood count test indicated thrombocytopenia, rising in hematocrit and hemoglobin. Blood transfusions, intravenous fluid and medications were given afterward. Upon hospitalization, the patient was already in a severe condition. The patient had survived only for about 9 hours after admission. Prior to death, the physical examination showed hypotension, arrhythmia, and tachypnea.

Conclusions: Late admission is the major contributing factors of DHF mortality among children. It is necessary to set a minimum duration of fever that needs hospitalization and improve awareness among the population to avoid risk of death. Awareness of DHF signs and symptoms is crucial, especially for parents with DHF children. Since plasma leakage and low thrombocyte count are also associated to mortality, early and regular monitoring of these indicators are critical to prevent serious complications. Progressivity to critical stage not only involving plasma leakage indicators but also other clinical symptoms, such as hepatomegaly and gastrointestinal bleeding.

Keywords: Infant, Dengue shock syndrome, Hospitalization, Mortality, Denpasar
12th Congress of the World Federation of Societies of Intensive and Critical Care Medicine in collaboration with WFCCN and WFPICCS

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