The 37th KSCCM Annual Congress and Asian Critical Care Conference 2018

April 27(Fri)-28(Sat), 2018
SEOUL DRAGON CITY, 3~5F

ABSTRACT BOOK
The 37th KSCCM Annual Congress and Asian Critical Care Conference 2018

You can download the Abstract book with QR Code.

초록집은 QR코드로 다운로드 받으실 수 있습니다.
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<th>Hall C (SHILLA 1-2-3)</th>
<th>Hall D (BAEKJE 2-3-4)</th>
<th>Hall E (GOGURYEO 1-2-3)</th>
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</table>
| 08:30-10:00 | Opening Ceremony and Plenary Lecture  
- Opening ceremony  
- Plenary lecture: Korean Sepsis Alliance (KSA)  
- Panel discussion | Broadcast (Audio and Video from Hall A) | Broadcast (Audio and Video from Hall A) | Broadcast (Audio and Video from Hall A) | Broadcast (Audio and Video from Hall A) |
| 10:00-10:30 | Coffee Break | | | | |
| 10:30-12:00 | Sepsis 1  
- Sepsis epidemiology in mainland china  
- Sepsis in Korea where are we going?  
- Mortality of Intensive Care Unit in Korea | Quality Care in the ICU  
- Promoting Value in the ICU, By Practicing Less Is More  
- Maintenance of Quality Care in the ICU | New Bleeding is Coming!  
- Management of TIC in the TEG Era  
- Can We Predict Massive Bleeding?  
- Reverseal of Novel Anticoagulants in Trauma | Rapid Response System  
- Introduction to rapid response system  
- How to set up RRS in Korea  
- RRS and patient safety policy in Korean hospitals | Research and ethics symposium  
- Tips for awesome tables and figures  
- How to submit and respond to reviewer comments |
| 12:00-13:00 | Luncheon 1  
(Simultaneous interpretation to English)  
- Medication Errors in ICU and CR | Luncheon 2  
(Simultaneous interpretation to English)  
- Achieving Zero CLABSI in Your Intensive Care Unit | Luncheon 3 | | |
| 13:00-14:00 | Poster Presentation  
(Poster01  
Language: English)  
(Poster02  
Language: English)  
(Poster03  
Language: English)  
(Poster04  
Language: English)  
(Poster05  
Language: English)  
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(Poster10  
Language: Korean)  
(Poster11  
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(Poster12  
Language: Korean)  
(Poster13  
Language: Korean) | | | | |
| 14:00-15:30 | Oral01-02  
(Simultaneous interpretation to Korean)  
- Impact of a sepsis bundle on patients’ outcome: education program to improve sepsis management and outcome  
- Do we need different fluid management strategies in early versus late sepsis?  
- Rational for adjunctive therapies for treatment of septic shock | Oral03-04  
(Langauge: English)  
(Simultaneous interpretation to Korean)  
- Special Lectures 1  
- Management/Guideline for mechanical ventilation in ARDS  
- Patient-ventilator asynchrony | Oral05-06  
(Language: Korean) | Oral07-08  
(Language: Korean) | Oral09-10  
(Language: Korean) |
| 15:30-16:00 | Coffee Break | | | | |
| 16:00-17:30 | Sepsis 2  
- Impact of a sepsis bundle on patients’ outcome: education program to improve sepsis management and outcome  
- Do we need different fluid management strategies in early versus late sepsis?  
- Rational for adjunctive therapies for treatment of septic shock | Rehabilitation in critical care  
- ICU Acquired Weakness and Long Term Patient Outcomes  
- The Evidence for Early Rehabilitation in the ICU  
- Culture Change to Promote Early Rehabilitation in the ICU | End-of-Life Care in the ICU  
- Caring of the Dying Patients in the ICU  
- Barriers on EOL Care in the ICU  
- Korean Professional Consensus for End-of-Life Care and Withholding/Withdrawing of Life-sustaining Treatment in the Intensive Care Unit  
- A Statement by the Task Force of Korean Society of Critical Care Medicine | Resuscitation  
- Physiologic changes in Post-cardiac arrest syndrome  
- Treatment Strategy during post-cardiac arrest period (focused on Monitoring and parameters)  
- Prognostication after cardiac arrest |

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### Program at a Glance, April 28 (Saturday), 2018

*All Broadcast source from Hall A (include Luncheon 1, Luncheon 4, General Assembly)*

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<tr>
<th>08:30-10:30</th>
<th>SY11 (Simultaneous Interpretation to English)</th>
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<th>SY19</th>
<th>SY23</th>
<th>SY27</th>
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<tbody>
<tr>
<td>ARDS 1</td>
<td>Early recognition of ARDS - Early ambulation or physical therapy in ARDS - Right heart failure in ARDS</td>
<td>Special Lectures 2 (Language English) - Compassionate and evidence-based palliative and end-of-life care in the intensive care unit - ICU-acquired weakness - Telemedicine applied to intensive care-Tel-ICU update</td>
<td>Thrombosis and thromboembolism in the ICU 1 - Thrombotic mechanisms and antithrombotic agents - Epidemiology and prevention of venous thrombosis in acutely ill medical patients - Challenging diagnosis of venous thromboembolism in the ICU</td>
<td>Toxicology - What is ’Toxic syndrome’? - How can we select &amp; use an antidote? - Extracorporeal elimination in acute poisoning</td>
<td>Perspective of Stroke management - Early management of patients with acute ischemic stroke - Endovascular Tx. - Early management of patients with acute ischemic strokes Surgical Tx. - Management of Spontaneous ICH</td>
</tr>
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| 10:00-10:30 | Coffee Break |

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<thead>
<tr>
<th>10:30-12:00</th>
<th>SY12 (Simultaneous Interpretation to English)</th>
<th>SY16 (Simultaneous Interpretation to Korean)</th>
<th>SY20</th>
<th>SY24</th>
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<tbody>
<tr>
<td>ARDS 2</td>
<td>Spontaneous breathing during MV in ARDS - Lung Protective Ventilation Strategy in ARDS - Proning position and recruitment maneuver in ARDS</td>
<td>ECMO 1: Practical Review (Language English) - Implementation of multidisciplinary ECMO team - ECCG3R for ARDS - ECMO in immunocompromised patients with ARDS - Extracorporeal blood cleansing device in experimental sepsis models</td>
<td>Thrombosis and thromboembolism in the ICU 2 - Anti-thrombotic agents and reversal agents at ER and ICU - Practical application and interpretation of coagulation test - ECMO in massive pulmonary embolism</td>
<td>The Beginning Era of Surgical Intensive Care Surgeon Asian Medical Center - Wuju Severance Christian Hospital - Yeungnam University Medical Center - Bucheon St Mary’s Hospital - Panel Discussion</td>
<td>Clinical applications of Critical care ultrasound - Critical care US for ventilator weaning - US-guided Venous catheterization - Musculoskeletal US in the ICU - Discussion</td>
</tr>
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<thead>
<tr>
<th>12:00-13:00</th>
<th>General Assembly</th>
<th>Luncheon 4 (Simultaneous Interpretation to English)</th>
<th>Luncheon 5 (Simultaneous Interpretation to English)</th>
<th>SY17 (Simultaneous Interpretation to Korean)</th>
<th>SY21</th>
<th>SY25</th>
<th>SY29</th>
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<tr>
<td></td>
<td>Broadcast (Audio and Video from Hall A)</td>
<td>Broadcast (Audio and Video from Hall A)</td>
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<tr>
<td></td>
<td>Lunchen 4</td>
<td>Lunchen 5</td>
<td>SY17 (Simultaneous Interpretation to Korean)</td>
<td>Critical Care Nutrition 1, Glutamine - Pro - Con - Panel Discussion 2, Selenium - Pro - Con - Panel Discussion</td>
<td>Critical Care Nursing - Infection Control and Indicator Management in ICU - Guidelines for Environmental Infection Control in ICU - Management of MDR (Multi-drug-Resistant Organism) in ICU</td>
<td>Critical Care Nursing - Infection Control in the ICU - Case definitions and validation of Korean national healthcare-associated infections surveillance system in ICU - 10 years’ achievement and the prospect of Korean national healthcare-associated infections surveillance system in ICU - Useful intervention to reduce burden of healthcare-associated infections in ICU</td>
<td>Neonuromonitoring and therapeutic approach in Neurocritical Care Unit - ICP monitoring and therapeutic approach - Metabolic monitoring and therapeutic approach - Cerebral Hemodynamics monitoring for severe brain injury</td>
</tr>
</tbody>
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<tr>
<th>13:30-15:00</th>
<th>SY13 (Simultaneous Interpretation to English)</th>
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<th>SY22</th>
<th>SY26</th>
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<tbody>
<tr>
<td></td>
<td>Sepsis 3 (Language English) - Mitochondria in Sepsis - SOFA as a tool to screen patients with infection at risk of sepsis - The role of hypothermic saline for fluid resuscitation in sepsis</td>
<td>qSOFA as a tool to screen patients with infection at risk of sepsis</td>
<td>GI Cases in the ICU - Family engagement &amp; empowerment in the ICU - Improvement of nurse knowledge and effect of reducing diarrhoea by application of CAP-ICU assessment tool and diarrhoea prevention activity</td>
<td>ECMO 2: Special Considerations 1, Neonate and Pediatric ECMO - Pediatric cardiac surgeon - Pediatric intensivist 2, Extracorporeal ECMO - Arrhythmia ablation - High-risk PCI - Airway surgery</td>
<td>Updated Korean guidelines in critical care medicine - Korean ICU Admision, Discharge, and Trauma Guidelines</td>
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<tr>
<td>Time</td>
<td>CR 1 (BAEKJE1)</td>
<td>CR 2 (BAEKJE 6+7)</td>
<td>CR 3 (BAEKJE 5)</td>
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<tr>
<td>09:00-11:00</td>
<td><strong>WS02</strong>&lt;br&gt;Hemodynamic optimization strategy in ICU 2&lt;br&gt;Language: English&lt;br&gt;1. Lecture&lt;br&gt;2. Technology review and hands-on&lt;br&gt; 1) Noninvasive technology session (with PLR)&lt;br&gt; 2) Pulse contour technology session&lt;br&gt; 3) Transpulmonary Thermodilution technology session&lt;br&gt;3. Simulation workshop&lt;br&gt;Contents: hemodynamic scenario in Neure-ICU</td>
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<tr>
<td>13:00-17:10</td>
<td><strong>WS03</strong>&lt;br&gt;Lung Ultrasound in the Critically Ill Course&lt;br&gt;- Course Introduction&lt;br&gt;- Simple Emergency Cardiac Sonography&lt;br&gt;- The lung, Introduction&lt;br&gt;- Q &amp; A, Break&lt;br&gt;- Lung Ultrasound, main clinical uses I: Acute Respiratory Failure (BLUE protocol)&lt;br&gt;- Lung Ultrasound, main clinical uses II: Acute Circulatory Failure (SALT5, SESAME)&lt;br&gt;- Lung Ultrasound as a monitoring tool&lt;br&gt;- Q &amp; A, Break&lt;br&gt;- Hands-on training part I: Routine views: Lung US / PSI x Aortic / Suncostal + V + Aortic&lt;br&gt;- Hands-on training part II: Clinical scenarios: Dypnea / Shock / Chest pain&lt;br&gt;- End of Course &amp; Certificate distribution</td>
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<tr>
<td>12:00-17:25</td>
<td><strong>WS04</strong>&lt;br&gt;Various application using CRRT machine&lt;br&gt;Considering points in extracorporal elimination using CRRT machine&lt;br&gt;- Introduction&lt;br&gt;- General principle using CRRT machine in critical care&lt;br&gt;- Understanding CRRT circuit and monitoring focused on troubleshooting conditions&lt;br&gt;- Special modes using CRRT device: Hemo-perfusion, plasmapheresis, ECMO, polymyxin B&lt;br&gt;- Break&lt;br&gt;- Simulation Introduction&lt;br&gt;- Simulation case 1 / 2&lt;br&gt;- Rotation&lt;br&gt;- Simulation case 2 / 1&lt;br&gt;- Take Home messages</td>
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### Program

**April 27 (Friday), 2018**

**♣ Hall A (HANRA 1+2), 3F ♣**

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<th>Time</th>
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<tr>
<td>08:30-10:00</td>
<td>Opening Ceremony and Plenary Lecture (Simultaneous Interpretation to English)</td>
<td>Sung Jin Hong (The Catholic University of Korea, Korea)</td>
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<tr>
<td>08:30-08:40</td>
<td>Opening ceremony</td>
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<tr>
<td>08:40-09:00</td>
<td>Plenary lecture: Launching the Korean Sepsis Alliance (KSA) Chae-Man Lim (University of Ulsan, Korea)</td>
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<tr>
<td>09:00-10:00</td>
<td>Panel discussion Gee Young Suh (Sungkyunkwan University, Korea)</td>
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<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
<td></td>
</tr>
<tr>
<td>10:30-12:00</td>
<td>SY01 / Sepsis 1 (Language: English, Korean) (Simultaneous Interpretation to English or Korean)</td>
<td>Shin Ok Koh (Chungang University, Korea)</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>- Sepsis Epidemiology in Mainland China Bin Du (Peking Union Medical College Hospital, China)</td>
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<tr>
<td>11:00-11:30</td>
<td>- Sepsis in Korea : Where are We Going? Hogeol Ryu (Seoul National University, Korea)</td>
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<tr>
<td>11:30-12:00</td>
<td>- Mortality of Intensive Care Unit in Korea Young Sam Kim (Yonsei University, Korea)</td>
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<tr>
<td>12:00-12:30</td>
<td>Luncheon 1 / Pfizer (Simultaneous Interpretation to English) Ho Geol Ryu (Seoul National University, Korea)</td>
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<tr>
<td>12:00-13:00</td>
<td>- Medication Errors in ICU and OR</td>
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<tr>
<td>13:00-14:00</td>
<td>Poster Presentation (5F, BAEKDU 1)</td>
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<tr>
<td>14:00-15:30</td>
<td>Oral01<del>02 (O-001</del>O-009) (Language: English) (Simultaneous Interpretation to Korean)</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
<td></td>
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<tr>
<td>16:00-17:30</td>
<td>SY02 / Sepsis 2 (Simultaneous Interpretation to English) Chae-Man Lim (University of Ulsan, Korea)</td>
<td></td>
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<tr>
<td>16:00-16:30</td>
<td>- Impact of a Sepsis Bundle on Patients' Outcome: Education Program to Improve Sepsis Management and Outcome Sunghoon Park (Hallym University, Korea)</td>
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<tr>
<td>16:30-17:00</td>
<td>- Do We Need Different Fluid-Management Strategies in Early Versus Late Sepsis? Young Jae Cho (Seoul National University, Korea)</td>
<td></td>
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<tr>
<td>17:00-17:30</td>
<td>- Rationale for Adjunctive Therapies for Treatment of Septic Shock Moo Suk Park (Yonsei University, Korea)</td>
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### Hall B (HANRA 3), 3F

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<td>08:30-10:00</td>
<td>Opening Ceremony and Plenary Lecture (Broadcast (Audio and Video from Hall A))</td>
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<td>10:00-10:30</td>
<td>Coffee Break</td>
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<tr>
<td>10:30-12:00</td>
<td>SY03 / Quality Care in the ICU (Language: English) (Simultaneous Interpretation to Korean)</td>
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<td>Chairpersons: Rebecca Aslakson (Stanford University, USA), Cheung-soo Shin (Yonsei University, Korea)</td>
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<tr>
<td>10:30-11:00</td>
<td>- Promoting Value in the ICU By Practicing Less Is More</td>
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<td>Jerry Zimmerman (Washington University, USA)</td>
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<tr>
<td>11:00-11:30</td>
<td>- Maintenance of Quality Care in the ICU</td>
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<td>Richard M. Pino (Massachusetts General Hospital, USA)</td>
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<tr>
<td>11:30-12:00</td>
<td>- Systems Engineering to Reduce Harm in the ICU</td>
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<td>Adam Sapirstein (Johns Hopkins School of Medicine, USA)</td>
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<tr>
<td>12:00-13:00</td>
<td>Luncheon 2 / 3M (Simultaneous Interpretation to English) Chairperson: Jae Yeol Kim (Chungang University, Korea)</td>
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<td></td>
<td>- Achieving Zero CLABSI in Your Intensive Care Unit</td>
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<td></td>
<td>Tae Hyong Kim (Soonchunhyang University, Korea)</td>
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<tr>
<td>13:00-14:00</td>
<td>Poster Presentation (5F, BAEKDU 1)</td>
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<tr>
<td>14:00-15:30</td>
<td>Oral03<del>04 (O</del>010<del>O</del>018) (Language: English) (Simultaneous Interpretation to Korean)</td>
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<td>15:30-16:00</td>
<td>Coffee Break</td>
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<tr>
<td>16:00-17:30</td>
<td>SY04 / Special Lectures 1 (Language: English) (Simultaneous Interpretation to Korean)</td>
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<td>Chairpersons: Wen-Jinn Liaw (National Defense Medical Center, Taiwan), Sang Hyun Kwak (Chonnam National University, Korea)</td>
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<tr>
<td>16:00-17:00</td>
<td>- Management/Guidelines for Mechanical Ventilation in ARDS</td>
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<td>Eddy Fan (University of Toronto, Canada)</td>
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<tr>
<td>17:00-17:30</td>
<td>- Patient-Ventilator Asynchrony</td>
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<td>Masaji Nishimura (Tokushima Prefecture Central Hospital, Japan)</td>
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### Hall C (SHILLA 1+2+3), 3F

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<td>Opening Ceremony and Plenary Lecture (Broadcast (Audio and Video from Hall A))</td>
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<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
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<tr>
<td>10:30-12:00</td>
<td>SY05 / New Bleeding is Coming!</td>
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<tr>
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<td>Chairperson: Nam Ryeol Kim (Korea University, Korea)</td>
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<tr>
<td>10:30-11:00</td>
<td>- Management of TIC in the TEG Era</td>
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<tr>
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<td>Jae Hun Kim (Pusan National University, Korea)</td>
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<tr>
<td>11:00-11:30</td>
<td>- Can We Predict Massive Bleeding?</td>
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<td>Jae Gil Lee (Yonsei University, Korea)</td>
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<tr>
<td>11:30-12:00</td>
<td>- Reversal of Novel Anticoagulants in Trauma</td>
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<td>Chi-Min Park (Sungkyunkwan University, Korea)</td>
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<tr>
<td>12:00-13:00</td>
<td>Luncheon 3 / MSD (Simultaneous Interpretation to English) Chairperson: Sang Bum Hong (University of Ulsan, Korea)</td>
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<td>- Therapeutic role of beta-lactam/beta-lactamase inhibitors in the era of MDR Gram-negative pathogens, with special emphasis on ceftolozane / tazobactam</td>
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<td>Cheol In Kang (Sungkyunkwan University, Korea)</td>
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<tr>
<td>13:00-14:00</td>
<td>Poster Presentation (5F, BAEKDU 1)</td>
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<tr>
<td>14:00-15:30</td>
<td>Oral05<del>06 (O</del>019<del>O</del>027) (Language: Korean)</td>
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<td>15:30-16:00</td>
<td>Coffee Break</td>
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<td>Time</td>
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<tr>
<td>16:00-17:30</td>
<td><strong>SY06 / Rehabilitation in critical care</strong></td>
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<tr>
<td>16:00-16:30</td>
<td>ICU Acquired Weakness and Long Term Patient Outcomes</td>
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<tr>
<td>16:30-17:00</td>
<td>The Evidence for Early Rehabilitation in the Intensive Care Unit</td>
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<tr>
<td>17:00-17:30</td>
<td>Culture Change to Promote Early Rehabilitation in the ICU</td>
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**Hall D (BAEKJE 2+3+4), 4F**

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<tr>
<td>08:30-10:00</td>
<td><strong>Opening Ceremony and Plenary Lecture</strong></td>
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<td>Hall D</td>
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<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
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<tr>
<td>10:30-12:00</td>
<td><strong>SY07 / Rapid Response System</strong></td>
<td><strong>Chairperson:</strong> Seok Chan Kim</td>
<td>Hall D</td>
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<tr>
<td>10:30-11:00</td>
<td>Introduction to Rapid Response System</td>
<td>Gee Young Suh (Sungkyunkwan University, Korea)</td>
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<tr>
<td>11:00-11:30</td>
<td>How to Set up RRS in Korea</td>
<td>Sang-Bum Hong (University of Ulsan, Korea)</td>
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<tr>
<td>11:30-12:00</td>
<td>RRS and Patient Safety Policy in Korean Hospitals</td>
<td>Hong Mo Goo (Korea Institute for Healthcare Accreditation, Korea)</td>
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<tr>
<td>12:00-13:00</td>
<td>Luncheon 1</td>
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<td>Hall D</td>
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<tr>
<td>13:00-14:00</td>
<td>Poster Presentation</td>
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<tr>
<td>14:00-15:30</td>
<td>Oral07–08 (O–028~O–037)</td>
<td>(Language: Korean)</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
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<tr>
<td>16:00-17:30</td>
<td><strong>SY08 / End-of-Life Care in the ICU</strong></td>
<td><strong>Chairperson:</strong> Younsuck Koh</td>
<td>Hall D</td>
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<tr>
<td>16:00-16:30</td>
<td>Caring of the Dying Patients in the ICU</td>
<td>Jae Young Moon (Chungnam National University, Korea)</td>
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<tr>
<td>16:30-17:00</td>
<td>Barriers on EOL Care in the ICU</td>
<td>So Young Park (Chungnam National University, Korea)</td>
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<tr>
<td>17:00-17:30</td>
<td>Korean Professional Consensus for End-of-life Care and Withholding/Withdrawing of Life-Sustaining Treatment in the intensive Care Unit: A statement by the Task Force of Korean Society of Critical Care Medicine</td>
<td>Se Hee Na (Yonsei University, Korea)</td>
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**Hall E (GOGURYEO 1+2+3), 5F**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chairperson</th>
<th>Location</th>
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<tbody>
<tr>
<td>08:30-10:00</td>
<td><strong>Opening Ceremony and Plenary Lecture</strong></td>
<td></td>
<td>Hall E</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
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<tr>
<td>10:30-12:00</td>
<td><strong>SY09 / Research and ethics symposium</strong></td>
<td><strong>Chairperson:</strong> Jae Hwa Cho</td>
<td>Hall E</td>
</tr>
<tr>
<td>10:30-11:15</td>
<td>Tips for Awesome Table and Figures</td>
<td>Jun Haeng Lee (Sungkyunkwan University, Korea)</td>
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<tr>
<td>11:15-12:00</td>
<td>How to Submit and Respond to Reviewer's Comments</td>
<td>Changsoo Kim (Yonsei University, Korea)</td>
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<tr>
<td>12:00-13:00</td>
<td>Luncheon 1</td>
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<td>Hall E</td>
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<tr>
<td>13:00-14:00</td>
<td>Poster Presentation</td>
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<td>Time</td>
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<tr>
<td>14:00-15:30</td>
<td>Oral 09-10 (O-038~O-046) (Language: Korean)</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
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<tr>
<td>16:00-17:30</td>
<td>SY10 / Resuscitation Chairperson: In-byung Kim (Myongji Hospital, Korea)</td>
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<tr>
<td>16:00-16:30</td>
<td>- Physiologic Changes in Post-Cardiac Arrest Syndrome</td>
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<td></td>
<td>Kyung Woon Jeung (Chonnam National University, Korea)</td>
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<tr>
<td>16:30-17:00</td>
<td>- Treatment Strategy during Post-Cardiac Arrest Period</td>
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<tr>
<td></td>
<td>(Focused on Monitoring and Parameters)</td>
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<td></td>
<td>Sung Phil Chung (Yonsei University, Korea)</td>
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<tr>
<td>17:00-17:30</td>
<td>- Prognostication after Cardiac Arrest</td>
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<td></td>
<td>Chun Song Youn (The Catholic University of Korea, Korea)</td>
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CR 1 (BAEKJE 1), 4F

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>12:00-13:00</td>
<td>책임지도 전문의 간담회</td>
</tr>
<tr>
<td>13:00-14:00</td>
<td>Oral 11-12 (O-047~O-056) (Language: Korean)</td>
</tr>
<tr>
<td>15:30-17:30</td>
<td>WS01 / Hemodynamic optimization strategy in ICU 1 (Language: English)</td>
</tr>
<tr>
<td></td>
<td>1. Lecture (30min)</td>
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<td></td>
<td>Kiwon Lee (Robert Wood Johnson University, USA)</td>
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<td></td>
<td>2. Technology review and hands on (30min)</td>
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<td></td>
<td>1) Noninvasive technology session (with PLR)</td>
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<td>2) Pulse contour technology session</td>
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<td></td>
<td>3) Transpulomonary Thermodilution technology session</td>
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<td></td>
<td>Operator: Debbie Brodrick or Sanjog Chavan</td>
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<td></td>
<td>3. Simulation workshop (30min)</td>
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<td></td>
<td>Contents: hemodynamic scenario in Neuro-ICU</td>
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<td></td>
<td>Operator: Debbie Brodrick or Sanjog Chavan</td>
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CR 3 (BAEKJE 5), 4F

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<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>14:00-15:30</td>
<td>Oral 13-15 (O-057~O-065) (Language: Korean)</td>
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### April 28 (Saturday), 2018

**Hall A (HANRA 1+2), 3F**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chairperson</th>
<th>Location</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30-10:00</td>
<td>SY11 / ARDS 1</td>
<td>Young Joo Lee (Ewha Womans University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td>Yeon Joo Lee (Seoul National University, Korea)</td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>- Early Recognition of Acute Respiratory Distress Syndrome</td>
<td>Yeon Joo Lee</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td>Chi Ryang Jung (Sungkyunkwan University, Korea)</td>
</tr>
<tr>
<td>09:00-09:30</td>
<td>- Early Ambulation or Physiotherapy in ARDS</td>
<td>Chi Ryang Jung</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td>Kyeongman Jeon (Sungkyunkwan University, Korea)</td>
</tr>
<tr>
<td>09:30-10:00</td>
<td>- Right Heart Failure in Acute Respiratory Distress Syndrome</td>
<td>Kyeongman Jeon</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>10:00-10:30</td>
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<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>10:30-12:00</td>
<td>SY12 / ARDS 2</td>
<td>Heung Bum Lee (Chonbuk National University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>10:30-11:00</td>
<td>- Spontaneous Breathing during Mechanical Ventilation: Benefits and Harms</td>
<td>Chae-Man Lim</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td>Je Hyeong Kim (Korea University, Korea)</td>
</tr>
<tr>
<td>11:00-11:30</td>
<td>- Lung Protective Ventilation Strategy in ARDS</td>
<td>Je Hyeong Kim</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td>So Young Park (Chungnam National University, Korea)</td>
</tr>
<tr>
<td>11:30-12:00</td>
<td>- Prone Position and Recruitment Maneuver in ARDS</td>
<td>So Young Park</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>12:00-12:30</td>
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<tr>
<td>12:30-13:30</td>
<td>Luncheon 4 / Pfizer</td>
<td>Chae-Man Lim (University of Ulsan, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td></td>
</tr>
<tr>
<td>12:30-13:30</td>
<td>- Effective Infection Management for Critically Ill Patients in ICU Settings</td>
<td>Won Yeon Lee</td>
<td>Hall A (HANRA 1+2), 3F</td>
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</tr>
<tr>
<td>13:30-15:00</td>
<td>SY13 / Critical Care Nutrition</td>
<td>Ji-Young Sul (Chungnam National University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>13:30-13:45</td>
<td>- Glutamine -Pro-</td>
<td>Ho Hyun Kim (Pusan National University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>13:45-14:00</td>
<td>- Glutamine in the ICU : Cons</td>
<td>Jae Myeong Lee (Korea University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>14:00-14:15</td>
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<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>14:15-14:30</td>
<td>- Selenium: Pro for Patients with Critical Illness</td>
<td>Im-kyung Kim (Yonsei University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>14:30-14:45</td>
<td>- Selenium - Con</td>
<td>Tae Sun Ha (Soonchunhyang University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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<td>14:45-15:00</td>
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<td>Hall A (HANRA 1+2), 3F</td>
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<tr>
<td>15:00-16:30</td>
<td>SY14 / Pain, agitation and delirium in ICU</td>
<td>Dong Chan Kim (Chonbuk National University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td></td>
</tr>
<tr>
<td>15:00-15:30</td>
<td>- Neurological Examination of Critically Ill Patients</td>
<td>Jung-Ah Lim (Hallym University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td></td>
</tr>
<tr>
<td>15:30-16:00</td>
<td>- Pain Control in Critical Care</td>
<td>Kyeongman Jeon (Sungkyunkwan University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
<td></td>
</tr>
<tr>
<td>16:00-16:30</td>
<td>- Postoperative Delirium: Perioperative Risk Management</td>
<td>Sungwon Na (Yonsei University, Korea)</td>
<td>Hall A (HANRA 1+2), 3F</td>
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</tbody>
</table>
Dar Hall B (HANRA 3), 3F

08:30-10:00  SY15 / Special Lectures 2 (Language: English) (Simultaneous Interpretation to Korean)

Chairpersons: Chairat Permpikul (Mahidol University, Thailand), Jong Heon Jun (Hanyang University, Korea)

08:30-09:00  - Compassionate and Evidence-Based Palliative and End-of-Life Care in the Intensive Care Unit
Rebecca A. Aslakson (Stanford University, USA)

09:00-09:30  - ICU-Acquired Weakness
Masaji Nishimura (Tokushima Prefecture Central Hospital, Japan)

09:30-10:00  - Telemedicine Applied to Intensive Care - Tele-ICU Update
Adam Sapirstein (Johns Hopkins School of Medicine, USA)

10:00-10:30  Coffee Break

10:30-12:00  SY16 / ECMO 1: Practical Review (Language: English) (Simultaneous Interpretation to Korean)

Chairpersons: Mathieu Schmidt (Universite Pierre et Marie CURIE, France), Sang Bum Hong (University of Ulsan, Korea)

10:30-10:45  - Implementation of Multidisciplinary ECMO Team
Shigeo Oda (Chiba University, Japan)

10:45-11:10  - ECCO2R for ARDS
Eddy Fan (University of Toronto, Canada)

11:10-11:35  - ECMO for Immunocompromised Patients
Mathieu Schmidt (Universite Pierre et Marie CURIE, France)

11:35-12:00  - An Extracorporeal Blood Cleansing Device in Sepsis Models
Joo Hun Kang (UNIST, Korea)

12:00-12:30  General Assembly (Broadcast (Audio and Video from Hall A))

12:30-13:30  Luncheon 5 / Yuhan (Simultaneous Interpretation to English)

Chairperson: Won-II Choi (Kyelmyung University, Korea)

12:30-13:30  - Optimal treatment strategy for multi-drug resistant gram-negative bacteria
Young Kyung Yoon (Korea University, Korea)

13:30-15:00  SY17 / Sepsis 3 (Language: English) (Simultaneous Interpretation to Korean)

Chairpersons: Jerry Zimmerman (Washington University, USA), Younsuck Koh (University of Ulsan, Korea)

13:30-14:00  - Mitochondria in Sepsis
Kiichi Nakahira (Weill Cornell Medical College, USA)

14:00-14:30  - qSOFA as a Tool to Screen Patients with Infection at Risk of Sepsis?
Bin Du (Peking Union Medical College Hospital, China)

14:30-15:00  - The Role of Hypertonic Saline for Fluid Resuscitation in Sepsis
Wen-Jinn Liaw (National Defense Medical Center, Taiwan)

15:00-16:30  SY18 / Sepsis 4 (Language: English) (Simultaneous Interpretation to Korean)

Chairpersons: Masaji Nishimura (Tokushima Prefecture Central Hospital, Japan), Sung Jin Hong (The Catholic University of Korea, Korea)

15:00-15:30  - Carbon Monoxide in the Treatment of Sepsis
Kiichi Nakahira (Weill Cornell Medical College, USA)

15:30-16:00  - Use of Vasopressors in Sepsis
Chairat Permpikul (Mahidol University, Thailand)

16:00-16:30  - Cytokine Adsorbing Hemofilter for the Treatment of Septic Shock
Shigeto Oda (Chiba University, Japan)
### Hall C (SHILLA 1+2+3), 3F

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chairperson</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30-10:00</td>
<td>SY19 / Thrombosis and thromboembolism in the ICU 1</td>
<td>Won-II Choi (Keimyung University, Korea)</td>
<td>Hall C (SHILLA 1+2+3), 3F</td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>- Thrombotic Mechanisms and Antithrombotic Agents</td>
<td>Jinwoo Lee (Seoul National University, Korea)</td>
<td>Hall C (SHILLA 1+2+3), 3F</td>
</tr>
<tr>
<td>09:00-09:30</td>
<td>- Epidemiology and Prevention of Venous Thrombosis in Acutely ill Medical Patients</td>
<td>Yun Su Shim (Hallym University, Korea)</td>
<td>Hall C (SHILLA 1+2+3), 3F</td>
</tr>
<tr>
<td>09:30-10:00</td>
<td>- Challenging Diagnosis: Venous Thromboembolism in the ICU</td>
<td>Young Seok Lee (Korea University, Korea)</td>
<td>Hall C (SHILLA 1+2+3), 3F</td>
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<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
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<td>Hall C (SHILLA 1+2+3), 3F</td>
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### Hall D (BAEKJE 2+3+4), 4F

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<th>Time</th>
<th>Session</th>
<th>Chairperson</th>
<th>Location</th>
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<tbody>
<tr>
<td>08:30-10:00</td>
<td>SY23 / Toxicology</td>
<td>Sung Woo Lee (Korea University, Korea)</td>
<td>Hall D (BAEKJE 2+3+4), 4F</td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>- What is “Toxic Syndrome (Toxidrome)?”</td>
<td>Hyunggook Kang (Hanyang University, Korea)</td>
<td>Hall D (BAEKJE 2+3+4), 4F</td>
</tr>
<tr>
<td>09:00-09:30</td>
<td>- How Can We Select &amp; Use an Antidote?</td>
<td>Hyun Kim (Yonsei University, Korea)</td>
<td>Hall D (BAEKJE 2+3+4), 4F</td>
</tr>
<tr>
<td>09:30-10:00</td>
<td>- Extracorporeal Elimination in Acute Poisoning</td>
<td>Hyo-Wook Gil (Soonchunhyang University, Korea)</td>
<td>Hall D (BAEKJE 2+3+4), 4F</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
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<td>Hall D (BAEKJE 2+3+4), 4F</td>
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<td>Time</td>
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<tr>
<td>10:30-12:00</td>
<td>SY24 / The Beginning Era of Surgical Intensivist: Acute Care Surgeon</td>
<td>Nam Ryeol Kim (Korea University, Korea)</td>
<td>Hall E (GOGURYEO 1+2+3), 5F</td>
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<tr>
<td>10:30-10:45</td>
<td>- Acute Care Surgery - Asan Medical Center</td>
<td>Suk-Kyung Hong (University of Ulsan, Korea)</td>
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<tr>
<td>10:45-11:00</td>
<td>- Wonju Severance Christian Hospital</td>
<td>Ji Young Jang (Yonsei University, Korea)</td>
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<tr>
<td>11:00-11:15</td>
<td>- Yeungnam university medical center</td>
<td>Jeong-Min Bae (Yeungnam University, Korea)</td>
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<td>11:15-11:30</td>
<td>- Bucheon St Mary's Hospital</td>
<td>Jinbeom Cho (The Catholic University of Korea, Korea)</td>
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<tr>
<td>11:30-12:00</td>
<td>- Panel Discussion</td>
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<tr>
<td>12:00-12:30</td>
<td>General Assembly</td>
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<td>12:30-13:30</td>
<td>Luncheon 4</td>
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<tr>
<td>13:30-15:00</td>
<td>SY25 / Infection Control in the ICU</td>
<td>Young Sam Kim (Yonsei University, Korea)</td>
<td></td>
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<tr>
<td>13:30-14:00</td>
<td>- Case Definitions and Validation of Korean National Healthcare-Associated Infections Surveillance System (KONIS) in ICU</td>
<td>Yee Gyung Kwak (Inje University, Korea)</td>
<td></td>
</tr>
<tr>
<td>14:00-14:30</td>
<td>- 10 Years' Achievement and Prospect of Korean National Healthcare-Associated Infections Surveillance System in ICU</td>
<td>Jun Yong Choi (Yonsei University, Korea)</td>
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</tr>
<tr>
<td>14:30-15:00</td>
<td>- Useful Intervention to Reduce Burden of Healthcare-Associated Infections in ICU</td>
<td>So-yeon Yoo (The Catholic University of Korea, Korea)</td>
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<tr>
<td>15:00-16:25</td>
<td>SY26 / ECMO 2: Special Considerations</td>
<td>Ki Ick Sung (Sungkyunkwan University, Korea)</td>
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<tr>
<td>15:00-15:20</td>
<td>- ECMO for Neonate and Pediatric Patients</td>
<td>Jae Gun Kwak (Seoul National University, Korea)</td>
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<tr>
<td>15:20-15:40</td>
<td>- Current Status of Neonatal and Pediatric ECMO</td>
<td>Hwa Jin Cho (Chonnam National University, Korea)</td>
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<tr>
<td>15:40-15:55</td>
<td>- Extracorporeal Life Support during Hemodynamic Unstable VT Ablation</td>
<td>Jae Seung Jung (Korea University, Korea)</td>
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<tr>
<td>15:55-16:10</td>
<td>- High Risk PCI</td>
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<tr>
<td>16:10-16:25</td>
<td>- Airway Surgery</td>
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<tr>
<td>08:30-10:00</td>
<td>SY27 / Perspective of Stroke management</td>
<td>Sang Hyung Lee (Seoul National University, Korea)</td>
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<tr>
<td>08:30-09:00</td>
<td>- Early Management of Patients with Acute Ischemic Stroke: Endovascular Tx</td>
<td>Hyon-Jo Kwon (Chonnam National University, Korea)</td>
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<tr>
<td>09:00-09:30</td>
<td>- Early Management of Patients with Acute Ischemic Stroke: Surgical Treatment</td>
<td>Ik Sung Park (The Catholic University of Korea, Korea)</td>
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</tr>
<tr>
<td>09:30-10:00</td>
<td>- Management of Intracerebral Hemorrhage</td>
<td>WONKI YOON (Korea University, Korea)</td>
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<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
<td></td>
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<tr>
<td>10:30-12:00</td>
<td>SY28 / Clinical applications of Critical care ultrasound</td>
<td>Youngrock Ha (Bundang Jesaeng Hospital, Korea)</td>
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<tr>
<td>10:30-10:55</td>
<td>- Critical Care US for Ventilator Weaning</td>
<td>Kyungsoo Chung (Yonsei University, Korea)</td>
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<tr>
<td>10:55-11:20</td>
<td>- US-Guided Venous Catheterization</td>
<td>Eunmi Gil (Sungkyunkwan University, Korea)</td>
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<tr>
<td>11:20-11:45</td>
<td>- Musculoskeletal Ultrasound in the ICU</td>
<td>Jinwoo Lee (Seoul National University, Korea)</td>
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<tr>
<td>11:45-12:00</td>
<td>- Discussion</td>
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<tr>
<td>12:00-12:30</td>
<td>General Assembly (Broadcast (Audio and Video from Hall A))</td>
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<tr>
<td>12:30-12:30</td>
<td>Luncheon 4 (Broadcast (Audio and Video from Hall A))</td>
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| 13:30-15:00  | **SY29 / Neurmonitoring and therapeutic approach in Neurological Critical Care Unit**<br>Chairperson: Sung Hee Hwang (Hallym University, Korea)
| 13:30-14:00  | - ICP Monitoring and Therapeutic Approach<br>Sang-Beom Jeon (University of Ulsan, Korea) |
| 14:00-14:30  | - Metabolic Monitoring and Therapeutic Approach<br>Ji Man Hong (Ajou University, Korea) |
| 14:30-15:00  | - Cerebral Hemodynamic Monitoring for Severe Brain Injury<br>Sang-Bae Ko (Seoul National University, Korea) |
| 15:00-16:30  | **SY30 / Updated Korean guidelines in critical care medicine**<br>Chairperson: Won-Il Choi (Kyeimyung University, Korea)
| 15:00-15:30  | - Korean ICU Admission, Discharge, and Triage Guidelines 1<br>Jae Seung Jung (Korea University, Korea) |
| 15:30-16:00  | - Korean ICU Admission, Discharge, and Triage Guidelines 2<br>Sunghoon Park (Hallym University, Korea) |
| 16:00-16:30  | - Revised Korean Glossary of Critical Care Medicine<br>Youjin Chang (Inje University, Korea) |

◊ CR 1 (BAEKJE 1), 4F ◊

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| 09:00-11:00  | **WS02 /Hemodynamic optimization strategy in ICU 2 (Language: English)**
|              | 1. Lecture (30min)<br>Kiwon Lee (Robert Wood Johnson University, USA) |
|              | 2. Technology review and hands on (30min)<br>Operator: Debbie Brodrick or Sanjog Chavan  
|              | 1) Noninvasive technology session (with PLR)  
|              | 2) Pulse contour technology session  
|              | 3) Transpulmonary Thermodilution technology session  
|              | 3. Simulation workshop (30min)<br>Contents: hemodynamic scenario in Neuro-ICU |
| 13:00-17:10  | **WS03 / Lung Ultrasound in the Critically Ill Course**
|              | Instructors<br>Youngrock Ha (Bundang Jesaeng Hospital, Korea)  
|              | Han Ho Do (Dongguk University, Korea)  
|              | Chan Young Koh (Dankook University, Korea)  
|              | Jinwoo Lee (Seoul National University, Korea)  
|              | Kyung-soo Chung (Yonsei University, Korea)  
|              | Young-Jae Cho (Seoul National University, Korea)  
| 13:00-13:10  | Course Introduction |
| 13:10-13:30  | Simple Emergency Cardiac Sonography |
| 13:30-13:50  | The lung, Introduction |
| 13:50-14:00  | Q & A, Break |
| 14:00-14:15  | Lung Ultrasound, main clinical uses I: Acute Respiratory Failure (BLUE protocol) |
| 14:15-14:30  | Lung Ultrasound, main clinical uses II: Acute Circulatory Failure (FALLS, SESAME) |
14:30-14:45  Lung Ultrasound as a monitoring tool

14:45-15:00  Q & A, Break

15:00-16:00  Hands-on training part I, Routine views: Lung US / PSLA+AP4C / Suncostal+IVC+Aorta

16:00-17:00  Hands-on training part II, Clinical scenarios: Dypnea / Shock / Chest pain

17:00-17:10  End of Course & Certificate distribution

◊ CR 2 (BAEKB 6+7), 4F ◊

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13:05-13:35  General principle using CRRT machine in critical care
13:35-13:55  Understanding CRRT circuit and monitoring focused on troubleshooting conditions
13:55-14:35  Special modes using CRRT device-Hemoperfusion, plasmapheresis, ECMO, polymyxin B

14:35-14:55  Coffee Break
14:55-15:00  Simulation Introduction
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**Chairperson: Nam Ryeol Kim (Korea University, Korea)**

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**Chairperson: Young Sam Kim (Yonsei University, Korea)**

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**Chairperson: Ki Ick Sung (Sungkyunkwan University, Korea)**

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**Chairperson: Sang Hyung Lee (Seoul National University, Korea)**

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**Chairperson: Youngrock Ha (Bundang Jesaeng Hospital, Korea)**

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**Chairperson: Sung Hee Hwang (Hallym University, Korea)**

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## SY30 / Updated Korean guidelines in critical care medicine

**Chairperson: Won-II Choi (Kyemyung University, Korea)**

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Cheng-He Lu*
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Department of Rehabilitation Medicine, Pusan National University Hospital, Pusan National University, College of Medicine, Busan, Republic of Korea, Division of Energy and Electric Engineering, Ewhak University, Gyeongju, Korea, School of Mechanical Engineering, Pusan National University, Busan, Korea

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April 27 (Friday), 2018

Hall A (HANRA 1+2), 3F
- Plenary lecture
  Chairperson: Sung Jin Hong (The Catholic University of Korea, Korea)
- SY01 / Sepsis 1 (Language: English, Korean) (Simultaneous Interpretation to English or Korean)
  Chairperson: Shin Ok Koh (Chungang University, Korea)
- SY02 / Sepsis 2 (Simultaneous Interpretation to English)
  Chairperson: Chae-Man Lim (University of Ulsan, Korea)

Hall B (HANRA 3), 3F
- SY03 / Quality Care in the ICU (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Rebecca Aslakson (Stanford University, USA), Cheung-soo Shin (Yonsei University, Korea)
- SY04 / Special Lectures 1 (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Wen-Jinn Liaw (National Defense Medical Center, Taiwan)
  Sang Hyun Kwak (Chonnam National University, Korea)

Hall C (SHILLA 1+2+3), 3F
- SY05 / New Bleeding is Coming!
  Chairperson: Nam Ryeol Kim (Korea University, Korea)
- SY06 / Rehabilitation in critical care
  Chairperson: Gee Young Suh (Sungkyunkwan University, Korea)

Hall D (BAEKJE 2+3+4), 4F
- SY07 / Rapid Response System
  Chairperson: Seok Chan Kim (The Catholic University of Korea, Korea)
- SY08 / End-of-Life Care in the ICU
  Chairperson: Younsuck Koh (University of Ulsan, Korea)

Hall E (GOGURYEO 1+2+3), 5F
- SY09 / Research and ethics symposium
  Chairperson: Jae Hwa Cho (Yonsei University, Korea)
- SY10 / Resuscitation
  Chairperson: In-byung Kim (Myongji Hospital, Korea)
Launching the Korean Sepsis Alliance (KSA)

Asan Medical Center, Univ of Ulsan College of Medicine, Seoul, Korea

Chae-Man Lim

Sepsis is a disease in which the infection causes systemic inflammation and causes major organ dysfunction, leading to a mortality rate of 40% to 70% if not detected and treated early. According to a study published in 2012, mortality of Korean population with sepsis was 34.3%, and 38.9% according to a study published in 2015. This is twice the death rate compared with that in developed countries. The annual incidence of sepsis in Korea is estimated to be similar to or more than TB, the most important public health issue in our society. However, the death toll is several times the number of tuberculosis deaths per year. In particular, the incidence in the economically active population group of 18-60 years was 46,895 persons in 5 years, or 9,379 persons per year. Of these, 13,470 were killed, which corresponds to 2,694 deaths per year.

Sepsis is the alpha and omega of modern critical care, and in this regard the outcome of sepsis represents the level of ICU in that country. Experience in developed countries suggests that early detection of sepsis and higher compliance rates of treatment bundle may lead to a direct reduction in mortality. In Korea, sepsis should now be recognized as one of the most urgent health issues by the policy makers, government, and by the public as well. With these necessities in the background, the Korean Society of Intensive Care Medicine is determined to launch the Korean Sepsis Alliance as of this year.
Sepsis Epidemiology in Mainland China

Medical ICU, Peking Union Medical College Hospital Beijing, China

Bin Du

As the leading cause of death in intensive care unit (ICU) patients, epidemiology of sepsis remains poorly understood in middle- and low-income countries, including mainland China. The first report of epidemiological study of sepsis in mainland China came from a prospective cohort study in 10 surgical ICUs in university hospitals in 2004, which reported a prevalence of severe sepsis and septic shock of 8.7%, with hospital mortality about 45%. In a prospective cohort study in 22 general ICUs in 2009, 37.3% of adult patients with ICU length of stay more than 24 hours developed severe sepsis/septic shock, which was similar to the average prevalence of sepsis in European ICUs. However, these ICU-based studies were prone to underestimation, as up to 86% of septic patients might be managed in general wards rather than in ICU. Population-based epidemiology of sepsis was studied in only one retrospective cohort study of all hospitalized adults in a subdistrict of Beijing, which reported the standardized incidence of sepsis as 461 cases per 100,000 population, corresponding to 4.86 million cases per year in China. In addition, based on National Mortality Surveillance System, the preliminary data from an ongoing study found that 14.5% of all deaths was attributable to infection, corresponding to standardized mortality of 76.8 deaths/100,000 population, or more than 1 million deaths in 2015. Moreover, data on long-term outcomes were only available for 33 sepsis survivors, which suggested lower quality of life during a follow-up of up to 6 years. The above data suggested that the disease burden of sepsis was high in China, which was important for the design of relevant health care policies, allocation of limited health resources, and development of prevention measurements.
Sepsis in Korea: Where are We Going?

Seoul National University, Korea

Hogeol Ryu

Despite recent advances in identification and management of sepsis and septic shock, the disease burden and mortality rates are still substantial. However, the overall trend in outcomes after sepsis seems to be favorable and is attributed to efforts such as the surviving sepsis campaign.

The healthcare system of Korea is unique in that it is a single payer system regulated by a government agency. More than 97% of citizens in Korea benefit from this universal coverage system. Recent interest in big data and electronic health records represents an opportunity in recognizing an overview of high burden diseases such as sepsis.

In this review, the current status of sepsis in Korea over the past 10 years, comprising nearly 500,000 patients, will be presented. In-hospital mortality depending on relevant factors and risk factors of in-hospital mortality will also be presented.
Mortality of Intensive Care Unit in Korea

Department of Internal Medicine, Yonsei University College of Medicine

Young Sam Kim

Purpose: The purpose of this study is to estimate mortality of patient admitted to Intensive Care Unit (ICU) in Korea and investigate clinical characteristics of ICU patients using long-term nationwide cohort data.

Materials and Methods: This is a cohort study of all ICU admissions in patients above 1 month of age in Korea between 2011 and 2015. Total 1,498,102 admissions and 1,150,452 patient's national health insurance claim date are included in this study.

Results: Mean age at admission was 63.4 years. (Male: 61.3, Female 66.3). Most of the patients were above 60 years old. (Male: 58.4%, Female: 70.8%). About 22.1% of the patients applied mechanical ventilation and 4.1% of them maintained renal replacement therapy. Vasopressor drugs were used 15.0% of patients. About 40.0% of the patients admitted to tertiary university hospitals. 48.9% of ICU are managed by intensivists who dedicate much of their clinical practice to the ICU and intensivist was not working at all in the remaining ICU. Nurse to patient ratio was variable. 86.4% of the ICU in Korea, one nurse take care of more than 2.5 patients.

During five years, in hospital mortality is 12.8%. (13.1% in men and 12.6% in women). The median hospital length of stay was 12 days. In hospital and 28 days mortality tends to increase in male gender, older age and lower socioeconomic status group. The patient with mechanical ventilation, renal replacement therapy showed higher mortality. The mortality was lower in patient who admitted to the ICU of tertiary university hospital. The presence of intensivist and nurse to patient ratio were significant risk factors of death and mortality was increased to two or three times according to nurse to patient ratio.

Conclusion: Presence of intensivist and nurse to patient ratio were important risk factor of death who admitted to intensive care unit in Korea.
Impact of a Sepsis Bundle on Patients’ Outcome: Education Program to Improve Sepsis Management and Outcome

Hallym University Sacred Heart Hospital

Sunghoon Park

Since 2004, the Surviving Sepsis Campaign (SSC) group, in partnership with Institute for Healthcare Improvement (IHI), developed the SSC bundle, with the goal of reducing mortality by 25%. Although the 3-h and 6-h SSC bundles were introduced in the 2012, the 6-h bundle was revised in 2016 due to the negative results of three randomized controlled studies on the Early-Goal Directed Therapy (EGDT).

The implementation of sepsis bundle has been a cornerstone of sepsis performance improvement program, and many observational studies showed that performance improvement programs were associated with a significant increase in compliance with the sepsis bundles and a reduction in mortality. Levy and colleagues reported low mortality rates in high-compliant hospitals during a 7.5-year observation. Recent analysis using sepsis registry (in New York State) also reported that the compliance of 3-h sepsis bundle was associated with lower risk-adjusted in-hospital mortality. Among variables investigated, high-income countries, surgical ICUs, long duration of implementation, and presentation to Emergency Department seemed to be associated with high compliance. However, some authors observed that the rate of compliance continued to increase during the first 2 years of implementation, and there was a mortality reduction even when the bundle completion was delayed.

Importantly, many Asian intensive care units reported a low compliance rate with SSC bundles. In South Korea, the compliance rates was only 5.6%, which was associated with shortage of critical care personnel. These data highlight how important the sufficient critical care personnel (e.g., intensivists and nurses) are for improving performance. Therefore, through further studies, we should find solutions to increase bundle compliance, as well as other barriers.
Intravenous fluid therapy plays a fundamental role in the management of hospitalized patients. While the correct use of intravenous fluids can be lifesaving, recent literature demonstrates that fluid therapy is not without risks. Fluid resuscitation continues to be recommended as the first-line resuscitative therapy for all patients with severe sepsis and septic shock. The current acceptance of fluid therapy in sepsis is based in part on long history and familiarity with its use in the resuscitation of other forms of shock, as well as on an incomplete and incorrect understanding of the pathophysiology of sepsis.

Recently, the safety of intravenous fluids in patients with sepsis has been called into question with both prospective and observational data suggesting improved outcomes with less fluid or no fluid. Indeed, the use of certain types and volumes of fluid can increase the risk of harm, and even death, in some patient groups. Data from a recent audit show us that the inappropriate use of fluids may occur in up to 20% of patients receiving fluid therapy.

In this presentation, we review a recently proposed model for fluid therapy in severe sepsis and propose a framework by which it could be adopted for use in most situations where fluid management is required, defining 'Fit for purpose fluid therapy' tailored to the specific indications, time-, phase-dependent variables, or both, and the context of the patient. Considering the dose-effect relationship and side-effects of fluids, fluid therapy should be regarded similar to other drug therapy with specific indications and tailored recommendations for the type and dose of fluid. By emphasizing the necessity to individualize fluid therapy, we hope to reduce the risk to our patients and improve their outcome.

References

Rationale for Adjunctive Therapies for Treatment of Septic Shock

Division of pulmonology, Department of Internal Medicine, Yonsei University College of Medicine

Moo Suk Park

Sepsis is a leading cause of death and is estimated that roughly 100 per 100,000 inhabitants are hospitalized each year for an episode of sepsis (1), and septic shock may represent up to one out of ten ICU admissions (2).

Septic shock is characterized by a dysregulated host response to infection, resulting in life-threatening circulatory, cellular, and metabolic abnormalities (3). There is some evidence that implementation of the Surviving Sepsis Campaign guidelines is associated with improved patients outcomes, but the short-term mortality is still approximately 45 to 50% in septic shock (4).

Sepsis has no proven pharmacologic treatment, other than the appropriate antibiotic agents, fluids, and vasopressors as needed. The Surviving Sepsis Campaign guidelines highlighted the lack of a significant adjunct therapy including IV immunoglobulin, anti-coagulants, and immunomodulating supplements. Blood glucose levels should be moderately controlled and maintained of less than 180 mg/dL. Moderate doses of hydrocortisone should be given only to patients with refractory shock and up to the weaning of vasopressor therapy (5, 6).

The current review aimed at two recently reported adjunctive corticosteroid studies named by ADRENAL trial (7) and APROCCHSS trial (8). In addition vitamin C with hydrocortisone trial (9) and some innovative adjunct therapies that are currently under investigation were shortly reviewed.

Glucocorticoids have been used as an adjuvant therapy for septic shock for more than 40 years. Nonetheless, uncertainty about their safety and efficacy remains. Corticosteroids have been used in the treatment of patients with severe infections since the mid-twentieth century. However, their benefit-to-risk ratio, albeit evaluated in numerous trials, remains controversial. Corticosteroids improve cardiovascular function by restoring effective blood volume through increased mineralocorticoid activity and by increasing systemic vascular resistance, an effect that is partly related to endothelial glucocorticoid receptors (10, 11).

References

Promoting Value in the ICU By Practicing Less Is More

Washington University, USA

Jerry Zimmerman

Although most critical care providers are committed to the concept of enhancing quality of care, fewer have been engaged in augmenting overall value of care that includes both quality improving and cost lowering components. Wasteful health care practices are associated not only with financial harm, but emotional and physical harm as well. Recently two grass root, common sense quality improvement initiatives have been introduced that directly address individual participation to increase value in critical care. Choosing Wisely® for Critical Care suggests elimination of five common ICU practices that add cost, but do not add quality:

1) Don’t order diagnostic tests at regular intervals. 2) Don’t transfuse red blood cells in hemodynamically stable, non-bleeding patients with a reasonable hemoglobin concentration. 3) Don’t prescribe parenteral nutrition in adequately nourished patients during their first week.

4) Don’t deeply sedate mechanically ventilated patients without a specific indication and without daily attempts to lighten that sedation. 5) Don’t continue life support for patients at high risk for death or severely impaired functional recovery without also offering comfort care only. In addition accumulating evidence suggests that less oxygen, less fluids, less antibiotics, less radiographs and less immobilization might also be considered for this Less Is More list. More recently the Society of Critical Care Medicine’s ICU Liberation Collaborative proposed the ABCDEF Bundle as an approach to “usual care” in the ICU: A) Always prioritize treatment of pain. B) Undertake scheduled daily spontaneous breathing trials and spontaneous awakening trials. C) Be cognizant of the choice of drug classes utilized for sedation. D) Monitor for and minimize delirium. E) Facilitate early mobilization. F) Empower and engage families in the care plan. Utilization of the ABCDEF Bundle is associated with improved clinically meaningful, patient-centered outcomes. The unwritten engine of ICU Liberation is weaning: weaning sedation; weaning mechanical ventilation; and weaning or minimizing immobilization. Because the biggest waste in medicine is waiting, proactive, scheduled weaning will reduce waiting, decrease waste, and enhance value in the ICU. Fundamentally critical care practitioners can individually enhance value in the ICU: 1) By treating our patients and not laboratory test results. This practice will encourage all of us to get away from the computer and spend more time at the bedside. 2) By developing and utilizing clinical standard work. This practice should derive from evidence-based medicine when possible and from inclusive consensus building when evidence does not exist. 3) And finally, by “weaning” when appropriate, but at the same time, resisting the temptation to always just do something when watchful waiting may improve clarity. This practice will frequently allow us foster the concept that, "Less Is More". 
The principles of quality care in the ICU are essential for the well-being of our patients and as well as the attainment of goals for our hard work. We understand that quality care will reduce ventilator- and catheter-associated infections, limit the spread of multi-drug resistant organisms, and prevent the complications of *C. difficile*. But, defining exactly what quality metrics are needed may not be easy. There have been over 2,000 citations since 2008 each describing quality metrics for the ICU. Judging metric compliance by comparing results between ICUs within a hospital and ICUs in different hospitals may not be valid. It is not reasonable to compare the care of a patient with an upper gastrointestinal bleed in a small “community hospital” to a patient after repair of a ruptured abdominal aortic aneurysm in an academic medical center.

A good quality metric requires the identification of a problem that is important to the both the clinician and the patient, the collection of reliable data, the recognition that something can be done to correct a problem, a plan for the allocation of resources that may help with a long-lasting solution, and prompt feedback to the ICU staff. Randomized controlled studies are often used to set metrics but often these exclude many types of patients who we routinely care for in the ICU such as the elderly or those with multiple medical problems. Clinical trials may not be applicable to larger groups. A prime example of a “good idea” that proved flawed is the use of rigid glucose control. The initial studies resulted in a universal adoption of tight glucose control. However, these were done on surgical ICU patients and could not be extrapolated to those in medical ICUs. Meta-analyses later demonstrated that there was no mortality benefit with intensive therapy compared to conventional glucose control and there was a great risk for hypoglycemia. Yet, many institutions continued to use algorithms to tightly control glucose. They did not “de-adopt” an idea that originally was considered good but was now not applicable.

The most essential component to quality care is teamwork. This goal needs to be embraced by physicians and the nursing staff. Every staff member in the ICU at any level of responsibility should be empowered to bring forth ideas for improvement and identify breaches in quality care. For example, a patient’s nurse should be encouraged to remind a physician to gown and glove when entering the room of a patient who is isolated for a communicable disease. Patients and their families educated regarding the ICU culture of maintaining quality care such as these universal precautions. As the culture of teamwork becomes stronger, the maintenance of the quality of care in the ICU thrives.
It is estimated that avoidable harm contributes to greater than 200,000 patient deaths annually in the US alone. Growing awareness of quality gaps in care delivery have not led to uniform reductions in adverse events. Other industries, such as aviation, have used systems engineering methods to achieve high reliability in safety and other performance metrics.

Here we examine the case for systematically applying systems engineering tools to improving care in the ICU. We will discuss Emerge, a pilot project to demonstrate that applied systems engineering can prevent harm in the ICU. Additionally, we will highlight systems engineering demonstration projects at The Johns Hopkins University that have been sponsored by Agency for Healthcare Research and Quality (AHRQ). The successes and failures of these efforts will be outlined to better understand how systems engineering can be used to create a High Reliability ICU in the future. Such a High Reliability Care Unit (HRCU) will not only provide a safer environment but also operate with greater efficiency and patient satisfaction.
Management/Guidelines for Mechanical Ventilation in ARDS

University of Toronto, Canada

Eddy Fan

Acute respiratory distress syndrome (ARDS) is a devastating form of respiratory failure that accounts for 10% of intensive care unit admissions globally, representing over 3 million patients with ARDS annually. This life-threatening condition can be caused by a variety of pulmonary (e.g., pneumonia, aspiration) or non-pulmonary (e.g., sepsis, pancreatitis, trauma) insults, resulting in the development of non-hydrostatic pulmonary edema. Pathophysiologically, ARDS is characterized by acute, diffuse, inflammatory lung injury, leading to increased alveolar capillary permeability, increased lung weight, and loss of aerated lung tissue. Clinically, this presents as hypoxemia, with bilateral opacities on chest radiography, associated with decreased lung compliance, increased venous admixture and physiological dead space.

Unfortunately, mortality from ARDS remains unacceptably high (35% to 46%), with higher mortality being associated with greater degrees of lung injury severity at onset. Importantly, survivors often have substantial and persistent physical, neuropsychiatric, and neurocognitive morbidity that has been associated with significantly impaired quality of life up to 5 years after the patient has recovered from ARDS.

No pharmacologic treatments aimed at the underlying pathology have been shown to be effective, and management remains supportive with lung protective mechanical ventilation, with the goal of minimizing ventilator-induced lung injury (VILI). VILI is a form of iatrogenic, secondary lung injury that can potentiate a systemic inflammatory response, contributing to the development of multi-organ failure and death. Recent ATS/ESICM/SCCM guidelines on mechanical ventilation in adult patients with ARDS provide evidence-based recommendations for 6 interventions: strong recommendations for the use of volume- and pressure-limited ventilation and prone positioning for >12 hours/day in patients with severe ARDS; a strong recommendation against the routine use of HFOV; conditional recommendations for the use of lung recruitment maneuvers and high PEEP strategies in patients with moderate or severe ARDS; and insufficient data to make a recommendation for or against venovenous extracorporeal membrane oxygenation (VV ECMO) in patients with severe ARDS. These guidelines on the use of mechanical ventilation in patients with ARDS can assist clinicians in delivering evidence-based interventions that may lead to improved outcomes.

References

1. Fan E, Brodie D, Slutsky AS. Acute Respiratory Distress Syndrome – Advances in Diagnosis and Treatment. JAMA 2018;319:698-710.
Patient-Ventilator Asynchrony

Tokushima Prefecture Central Hospital

Masaji Nishimura

Patient-ventilator asynchrony is very common issue. Asynchrony influences patient’s outcome significantly. Asynchrony index is defined as the number of asynchrony events divided by the total respiratory rate. In this group of patients asynchrony index > 10%, duration of mechanical ventilation was significantly longer. The incidence of tracheostomy was also higher. Furthermore, mortality increased as asynchrony increased. It is important to detect asynchrony and correct it.

There are two types of asynchronies, cycling asynchrony and flow asynchrony. The majority of asynchronies are represented by auto-triggering, ineffective efforts, and double triggering. Auto-triggering is defined as ventilator assisted cycle without inspiratory effort of patient. Ineffective effort is defined as patient inspiratory effort not followed by a ventilator assisted cycle. Double triggering is two consecutive ventilator cycles separated with very short expiratory time.

Gold standard of asynchrony measures are phrenic neurogram and esophageal balloon catheter. However both measures are rarely used in ICU. Recently almost all ventilators have screen, and various waveform curves are displayed on it. Waveform analysis is the most available and least invasive measure for asynchrony. Waveform analysis is conducted by visually detecting particular patterns.

Cardiac oscillation, condensation in the ventilator limbs, secretions and leak are common causes of auto-triggering. Weak inspiratory efforts or inappropriate trigger setting, high-PSV, and auto-PEEP are major causes of ineffective efforts. In the case of double triggering, usually patient demand is greater than ventilator setting of volume/flow.

In an expiratory asynchrony, small spike at the end of inspiration is sometimes detected. Ventilator inspiration is longer than patient inspiration. Patient starts expiration while ventilator still delivers inspiratory flow.

Asynchrony worsens patient outcome Waveform analysis is the most available and least invasive measure for asynchrony. Majority of causes of asynchronies are removed with ease, and it is essential to detect it.
Management of TIC in the TEG Era

Department of Trauma and Surgical Critical Care, Pusan National University Hospital, Busan, Korea

Jae Hun Kim

Coagulation is a complex, dynamic, highly regulated and interwoven process involving a myriad of cells, molecules and structures. The model of coagulation that was conventionally taught was the cascade model of a series of proteolytic reactions that act as a biological amplifier. However, the limitations of this model of the hemostatic process become clear in clinical situations. The intrinsic and extrinsic pathways cannot be operating as independent, redundant pathways in vivo and it was also recognized that cells are important participants in this process, and that normal hemostasis requires cell associated tissue factor (TF) and platelets, in addition to the proteins of the coagulation cascade. So, new model of coagulation was proposed in 2001 by Hoffman and Munroe, and has become the accepted description of how hemostasis takes place in vivo. The cell base model proposes that hemostasis occurs in three distinct, but overlapping steps - initiation, amplification and propagation.

The activated partial thromboplastin time (aPTT) and prothrombin time (PT) are the most commonly used tests of coagulation. The aPTT is used to assess the contact activation and the integrity of the intrinsic coagulation pathway (factors XII, XI, IX and VIII) and final common pathway (factor II(prothrombin), V,X and fibrinogen). The PT is used to assess the integrity of the extrinsic pathway, which consists of TF and VIIa, and coagulation factors of the common pathway. As mentioned before, in vivo the coagulation reactions occur on specific cell surfaces, rather than on phospholipid surfaces as they do in the PT and aPTT assays. So, in many studies, standard coagulation tests cannot reflect the coagulopathy.

Recently, the unique changes in coagulation caused by trauma are starting to be understood, but it is very complex and remains mostly unknown. Trauma patients with coagulopathy are the largest consumers of blood and blood products and the decision of what, when and how much blood and blood product to transfuse is often empiric or based on traditional coagulation lab tests such as INR/PT, PTT and platelet count. Any delay in obtaining the lab results can lead to inadequate transfusion and increased morbidity and mortality. Thus in trauma, global, functional and immediately available laboratorial evaluation of hemostasis can improve both patient management and outcome.

Thromboelastography (TEG) have a chance to overcome many of the limitations of conventional coagulation tests, as they measure the entire coagulation process, from fibrin formation through to final clot strengthening and fibrinolysis. It provides a global and functional assessment of coagulation. In addition, the faster availability of results may assist clinical decisions of what, when and how much blood and products to transfuse. The studies on TEG-based transfusion algorithms suggested that while it can be used to construct transfusion guidelines, the blood products transfused differ according to the algorithm selected. Therefore, a standardized guideline for this is needed.

TEG has many of the characteristics of ideal tests for use in trauma including global evaluation of coagulation, both quantitative and functional assessment. It could have important roles in trauma in 3 ways: by promptly diagnosing early trauma coagulopathy (diagnostic tools); guiding blood transfusion and revealing patients’ prognosis. But, their potential clinical utility must be balanced against some limitations.
Can We Predict Massive Bleeding?

Department of Surgery, Yonsei University College of Medicine, Seoul, Korea

Jae Gil Lee

Massive bleeding is one of the causes of the traumatic death. In traumatized patients, coagulopathy is common, and may be developed at the scene of injury. Recently, early onset of trauma induced coagulopathy (TIC) rather than resuscitation associated coagulopathy (dilutional and consumptive) has a major role the occurrence of coagulopathy. TIC is associated with the higher mortality during the resuscitation.

Stages of the hemorrhagic shock is classified by 4 categories according to the AAST classification of hemorrhage. Hypotension is associated with severe bleeding more than 1500 ml of total blood volume, and tachycardia is a sign of bleeding more than 750 ml. However, these parameters are not specific and may not be associated with conjoined injuries including bleeding.

To predict the massive bleeding is a main therapeutic issue to manage the severely traumatize d patients. Several parameters have shown the association with massive bleeding in trauma patients.

Arterial pH, dynamic massive blood transfusion (DMBT) score consisted by 8 parameters- SBP, HR, hemoglobin(Hb), Hb drop within the first 2 h, INR, base deficit, unstable pelvic fracture and hemoperitoneum-, lactate, FAST positivity, neutrophil-to-lymphocyte ratio, shock index, and modified shock index are suggested as a predictable index associated with massive bleeding and transfusion in trauma patients.

By the way, there are no specific markers or predictor to suspect the severe bleeding in trauma patients. So, combination with injury mechanisms, vital signs, and laboratory results should be applied to predict the massive bleeding.

References

Novel oral anticoagulants (NOACs), referred to non-vitamin K oral anticoagulants (VKA) represent a potential break-through in anticoagulation pharmacology due to their predictable dose-response relationship without the need for routine monitoring and dose titration. Despite several favorable properties, a concern has been raised about the lack of an antidote or effective anticoagulation reversal strategy in emergency situation such as trauma.

Each agent has a comparatively short half-life (average 7–12 hours) compared with VKAs, withdrawal of anticoagulation with supportive care are often effective therapies for mild and moderate bleeding. However, the trauma patients with severe, life-threatening bleeding associated with hemodynamic instability requires immediate reversal of anticoagulation. Activated charcoal can decrease the absorption of NOACs, when administered within 2–3 hours of drug intake.

Fresh frozen plasma does not reverse the anticoagulation of dabigatran and is only partially effective in reversing the anticoagulant effect of direct Xa inhibitors. The efficacy of prothrombin complex concentrates (PCCs) in the reversal of either direct thrombin or factor Xa inhibitors has not been evaluated. Recombinant factor VIIa decreased bleeding times of dabigatran and rivaroxaban in animal bleeding models.

Idarucizumab is a humanized monoclonal antibody fragment that tightly binds and irreversibly inhibits dabigatran in a 1:1 ratio. Recently, full cohort analysis showed that idarucizumab rapidly, durably, and safely reversed the anticoagulant effect of dabigatran in emergency situations.

Andexanet alfa is a recombinant modified factor X molecule that possesses a specific binding site for factor X/Xa inhibitors.

Aripazine is a synthetic small molecule that can bind, non-covalently, and reverse the action of unfractionated and low molecular weight heparins, direct factor Xa inhibitors and direct thrombin inhibitors.

A decision to reverse anticoagulation in a patient who is either at risk for or who has experienced a prior thrombotic or thromboembolic event must be made after carefully consideration of potential benefits and risks.
ICU Acquired Weakness and Long Term Patient Outcomes

Department of Anesthesiology and Pain Medicine Anesthesia and Pain Research Institute Yonsei University College of Medicine

Sungwon Na

Critical care has focused on recovery from acute organ system failure and resuscitation. Neuromuscular abnormalities related to critical illness occur very commonly, but they were relatively underestimated and unnoticed. Intensive care unit acquired weakness (ICUAW) leading to severe functional impairments in ICU survivors, can be divided into two disease entities: critical illness polyneuropathy (CIP) and critical illness myopathy (CIM). Electrophysiologic study, muscle biopsy and physical exam are helpful to diagnose ICUAW. Several systemic reviews identified many risk factors including systemic inflammation, corticosteroids, hyperglycemia, and immobility.

Additional research is needed to identify its pathogenesis and testify preventive or therapeutic modalities for this disorder.

Muscle wasting syndromes associated with prolonged infection have long been recognized in ICU.

As the progress of critical care, survival of critically ill patients has been improved, but the physical and neurological complications have been underdiagnosed. Patients who survive critical illness are at risk for physical and neurological complications and immobilization from their long ICU stay make their quality of life worse. Herridge et al.1 followed 109 acute respiratory distress syndrome survivors for 12 months, and the authors found that their 6 minute walk distance was just 66% of the predicted value, while respiratory function was normal within 6 months after ICU discharge.

Definition, Epidemiology and Clinical Presentation

Various terms have been used to describe muscle wasting in critically ill patients. Acute quadriplegic myopathy, ICU acquired paresis, critical illness polyneuropathy (CIP), critical illness myopathy (CIM) are the examples of the terminologies, and we will use ICU-acquired weakness (ICUAW) in this review to embrace an overarching term for neuromuscular disease in the critically ill patients.

A prospective cohort study of the patients mechanical ventilated for 7 or more days revealed that 25.3% of the patient population showed clinical evidence of ICUAW,2 and independent predictors of ICUAP were female sex (OR 4.66; 95% CI, 1.19-18.30), the number of days with dysfunction of 2 or more organs (OR, 1.28; 95% CI, 1.11-1.49), duration of mechanical ventilation (OR, 1.10; 95% CI, 1.00-1.22), and administration of corticosteroids (OR, 14.90; 95% CI, 3.20-69.80). A systemic review of 24 clinical studies showed 46% of ICUAW incidence (655/1421) in critically ill patients.3

The risk factors of ICUAW are described in table 1.

| Hyperglycemia |
| Sepsis |
| Multiple organ failure |
| Corticosteroid |
| Muscle relaxants |
| Immobility |
| Catecholamine |
| Renal replacement therapy |
| Female |

Diagnosis

1. History
2. Physical examination
3. Electrophysiologic test
4. Muscle biopsy
Long-term Outcomes

ICUAW occurs in 25-75% of critically ill patients and physical complication may last over a few years. A one-year follow up of ARDS survivors showed persistent functional disability one year after discharge from the intensive care unit. Pulmonary function reached normal within 6 month but extrapulmonary conditions, specifically muscle wasting and weakness, were the most prominent complications and were responsible for much of the persistent functional disability. A systemic review of 36 studies revealed that only two thirds of the 263 patients reached complete functional recovery (breathing spontaneously and walking independently).  

References

Rehabilitation in the intensive care unit is becoming very important. However, there are many barriers to overcome in order to perform intensive care unit (ICU) rehabilitation in Korea. Many hospitals that do not perform ICU rehabilitation because we have no insurance system or fewer employees need to find ways to help patients with critical illness. One of them is to have faith in the need for ICU rehabilitation, and try to persuade the other members of the hospital one by one.

What worries me about when talking about ICU rehabilitation is whether the subject of disease should be discussed differently. I also think it is necessary to distinguish between the cases in which surgical treatment is required or performed. Therefore, rehabilitation therapy in the intensive care unit is not a simple area, nor can it be done exclusively with rehabilitation medicine alone.

Although some papers will not solve many of our problems at once, I would like to take a look at the importance of rehabilitation for early-stage ICUs, focusing on the new literature in 2017-2018. It will be a short time, but I hope it will be a good time to share experiences by the following themes.

1. Consequences of mechanical ventilation
2. Neuromuscular weakness related to critical illness
3. Reduction of postoperative pulmonary complications
4. Evidence of rehabilitation in critically ill adults
5. Cost-effectiveness of early rehabilitation

As you have devoted to patients in the ICU so far, I would like to ask for your continued support and care so that ICU rehabilitation can be settled.

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Culture Change to Promote Early Rehabilitation in the ICU

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Joo Han Song

Early mobilization of patients in the intensive care unit (ICU) is safe and feasible to improve patient outcomes including decreased mechanical ventilation duration and improved physical functioning and quality of life even after ICU discharge. However, it is not occurring as frequently as expected, and implementation or promotion of early mobility as part of routine care in ICU is challenging.

Identifying barriers to facilitate early mobilization is important, which can be organized into four categories: (1) patient-related barriers; (2) structural barriers; (3) ICU culture-related barriers; (4) process-related barriers. ICU culture barriers are not easy to overcome but are most important factor to promote early mobility in the ICU, which is related to multidisciplinary team approach. Other factors related to early mobility during mechanical ventilation could be dependent on the culture of critical care participants in the ICU. ICU culture means the prioritization for barriers and strategies by intensivists, nurses, and physiotherapist in the ICU.

Although culture change is difficult to achieve, reorganizing management with developing teamwork and linking interventions with patient-centered outcomes can facilitate mobility in the ICU. It is critical to overcome cultural barriers that identifying and agreeing on a need to change clinical practice with sharing the ideas and experience of patients outcomes. Recent evidences have been demonstrated successful culture change to promote patients early rehabilitation based on structured quality improvement (QI) project. Well-designed QI project can make increased adherence with ICU mobility, which consists of structured surveys and training program and sharing the experience of patients outcomes to adopt early mobility practice.

Using structured QI project is safe and feasible to make cultural changes in the ICU to promote early mobility by involving a multidisciplinary team. Education, training program, and reinforcement with rewards and competency have positive impact to implement early rehabilitation in the ICU for daily routine practice in ICU.
Introduction to Rapid Response System

Gee Young Suh

Rapid response system (RRS) is a system to improve the outcome of patients who are deteriorating unexpectedly in the hospital setting. It is conceptually made up of 4 major components. One is the “afferent component” whereby there is a mechanism to detect deteriorating patients in the ward. This is usually done by having medical team at the bedside call the RRS team when the patients’ conditions deteriorate crossing a certain threshold for that index. Sometimes a composite scores such as Modified Early Warning Score (MEWS) or National Early Warning Score (NEWS) is used. Now many hospitals are adopting electronic screening. The second component or efferent component is the team that actually goes to the bedside when the system is activated. It can be led by a medical doctor (Medical Emergency Team, MET) or this task can be carried out by medical personnel who may be a nurse, respiratory therapist or so on (Rapid Response Team). Sometimes this team can carry out other duties which carry over some of the roles of the ICU to the ward (Outreach Team). To be a mature RRS, two other components patient safety/process improvement component and governance administrative structure.

In Korea, RRS started as a pilot project in 2008 at Asan Medical Center and hospital-wide system started in 2009 at Asan Medical Center and Samsung Medical Center. As of end of 2017, 14 hospitals have some form of RRS. In most of the hospitals that run RRS in Korea, they have some calling criteria along with screening through EMR. Most of the first responders are nurses.

In the second half of 2018, the government have plans to reimburse for RRS. How the hospitals are reimbursed is not set yet. But one thing is sure, RRS is here to stay because the society is challenging the hospitals and medical establishment to make our hospitals safer.
How to Set up RRS in Korea

Asan Medical Center, Univ. of Ulsan College of Medicine

Sang-Bum Hong

There are several systems of RRS internationally, and several systems of RRS in Korea also.

Each hospital set up RRS by adjusting hospital’s situation. However now it is time to make Korean model of RRS.

Several committee members gathered and suggest Korean model by 3 grade.

We make grade by duration of operation time and working staffs including dedicated nurses and dedicated doctors.

1) 1 grade
- operating 24h and 7 days by dedicated nurses, at least one more dedicated doctors

2) 2 grade
- operating 16h and 7 days by dedicated nurses, dedicated doctors are optional

3) 3 grade
- operating 8h and 5 days by dedicated nurses, dedicated doctors are optional

I will show international systems and examples of RRS in Korea.
RRS and Patient Safety Policy in Korean Hospitals

Korea Institute for Healthcare Accreditation, Korea

Hong Mo Goo
Caring of the Dying Patients in the ICU

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Jae Young Moon

Despite considerable technologic breakthroughs in the provision of intensive care medicine, mortality in the ICU remains high. Thus the ICU clinicians should be competent in all aspects of comfort care in the last days for dying patients. The term “comfort care” is used here to describe a set of the most basic palliative care interventions that provide immediate relief of symptoms in a patient who is very close to death.

Multiple distressing symptoms affect hospitalized patients who have advanced, life-threatening illnesses, and some of these symptoms worsen as the patient approaches death. Management of these common symptoms is essential skill, and ICU clinicians must ensure that patients die with dignity. The clinician should become familiar with and learn to handle the symptoms such as pain, dyspnea, cough, xerostomia, nausea, vomiting, excessive oral secretion, constipation, fever, anxiety, delirium and others.

If the disease state of the patient is not curable, how can we determine the best treatment goals for the patient? The physician used to be the best situated to make decisions reflecting the patient’s best interests. However, it is no longer appropriate to assume a concordance between physician and patient values. Under the shared decision-making model, physicians work together with patients and their families to define the patient’s healthcare values, beliefs, and treatment preferences. The physician not only provides information about treatments but also recommends the treatments he or she believes to be most concordant with the patient's values and goals.

ICU leaders or dedicated professionals have the responsibility to find and resolve the barriers which lead to a decline in the quality of dying and death in their respective units. In order to do that, it is important to make a constant effort to communicate with colleagues, as well as with patients and their families. At the same time, ethics training programs for residents, critical care nurses, and fellows are necessary and should be administered in their hospital and ICU trainings.

According to recent studies, the ICU leaders should prepare clinical protocols and educational interventions to improve the quality of comfort care for dying patients in the ICUs.

References

Barriers on EOL Care in the ICU

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So Young Park

The traditional goals of intensive care are to reduce the morbidity and mortality associated with critical illness, maintain organ function, and restore health. Despite technological advances, death in the intensive care unit (ICU) remains commonplace. Initiatives to improve end-of-life care in intensive care units face several important barriers. These include inflated expectations for critical care therapies, which are shared by many clinicians and many patients and families; preoccupation with an unattainable level of prognostic certainty, delaying attention to palliative needs; and fragmentation of the healthcare team into separate "silos" of disciplines and specialties. Recent study showed that there were significant differences in reported barriers to EOL care by level of training, discipline, and institution, particularly in the education-training domain. Insufficient resident training in EOL care was reported as a large or huge barrier by a smaller proportion of residents (20%) than attendings (62%), fellows (55%) or nurses (36%) (p=0.001).

Especially, in Korea, discussion of death at the patient’s bedside is generally regarded as taboo. In a previous study, 55.1% of surveyed Koreans would avoid telling the truth to terminally ill patients for fear that doing so would negatively affect their condition. In another study, only 33% of Korean Americans agreed that one should tell a terminally ill patient about their prognosis. This culture could make it more difficult for physicians to discuss death and EOL care with patients.

The national healthcare system or economic status was also important factor to influence EOL care. Financial factors were revealed as a determining factor in EOL care decisions made by family members, due in part that financial burdens tend to increase with longer hospitalization. Recent in-depth interview study revealed that LST decisions were deeply associated with not only “the quality of their patient’s life” but also “the quality of family members’ lives”. Also, legal climate among countries was important factor that affect to decide EOL care.

Therefore, public support for policy related to medical and nursing care, in addition to social acknowledgement of problems related to discussions about death in medical facilities, should be prepared for dying patients. Advance care planning (ACP) can assist with making decisions about life-sustaining therapies (LST) for life-limited patients or those with chronic conditions to minimize unnecessary suffering and honor patients’ preferences during the dying process.

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Korean Professional Consensus for End-of-life Care and Withholding/Withdrawing of Life-Sustaining Treatment in the intensive Care Unit: A statement by the Task Force of Korean Society of Critical Care Medicine

Yonsei University, Korea

Se Hee Na

**Background:** “The Law about Hospice Palliative Care and the Life-Sustaining Treatment Decision System for Patients in the Dying Process”, which will be launched in February 2018, stipulates the scope of patients who are eligible for withholding/withdrawing of life-sustaining treatment and the range of medical care that could be withheld or withdrawn. Although intensive care unit (ICU) clinicians should be competent in all aspects of this care, including the practical and ethical aspects of withdrawing different modalities of life-sustaining treatment and the use of sedatives, analgesics, and nonpharmacological approaches to easing the suffering of the dying process, very few clinicians have been specifically trained to withdraw life-sustaining measures, and no comprehensive guidelines exist to help clinicians. Hence, these recommendations have been developed to help clinicians provide high-quality end of life care in the ICU and improve the care of ICU patients during the dying process.

**Methods:** These recommendations are based on the modified Delphi technique and include 72 action criteria and algorithms for 40 questions. We do not use an evidence grading system because most of the recommendations are based on ethical and legal principles that are not derived from empirically based evidence.

**Results:** We developed recommendations to address (1) preparing for withdrawal of life-sustaining measures; (2) assessment and management of distress; (3) pharmacological management; (4) patients and family centered care; (5) discontinuation of life-sustaining measures and monitoring; (6) legal form; (7) support for the clinical staff.

**Conclusion:** Although these recommendations are based on “The Law about Hospice Palliative Care and the Life-Sustaining Treatment Decision System for Patients in the Dying Process”, we did not try to ignore or rule out any clinical situations that are not covered by the law. ICU clinician should be able to identify individualized measures for provide the best benefit and care to patients in dying process.
Tips for Awesome Table and Figures

Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul Korea

Jun Haeng Lee

Currently, images in medical journals are produced in the form of digital image files. The quality of printed images can be easily recognized. However, what comprises the quality of a digital image file is more complex. Some images appear to have good quality when displayed on a computer monitor but do not have sufficient quality for scholarly publication. In this lecture, basic concepts of digital images for scholarly publication, such as resolution, raster images, and vector images, will be explained. The advantages and limitations of using PowerPoint for processing digital image files will also be touched on briefly.
의학 논문은 “어떤 사상에 관하여 체계적으로 자기견해적 적은 것으로 학술적인 연구결과를 발표하는 글”을 의미한다. 논문은 과학적 글쓰기의 하나로 가장 중요한 특성은 명확성이며 또한 동시에 연구결과를 의사소통하기 위한 목적을 가지고 있다. 즉, 연구결과는 다른 연구자에 의해서 재현이 가능하거나 재현을 기대할 수 있어야 한다는 것이다. 논문의 평가와 심사는 이러한 큰 틀 안에서 이루어진다.

논문을 완성하고 목표로 하는 저널에 투고를 하게 되면, 일반적으로 편집위원회에서 논문의 양식 등을 확인하고, 스크리닝 과정을 거치게 된다. 스크리닝은 편집자 혹은 편집위원회에서 가지고 있는 내부 기준에 따라 이루어지는데, 일반적으로는 연구의 독창성과 내용이 저널의 편집 방향과 일치하는지 논문의 질적 수준이 저널의 요구에 부합하는지 (originality는 있는지) 등을 판단하게 된다. SCI급 저널에서는 대부분의 논문이 이 단계에서 탈락한다. 편집자는 수많은 논문을 리뷰해야 하기 때문에 스크리닝 단계에서 골격하게 논문의 특성을 파악하기는 매우 어렵다. 대부분 cover letter와 초록, 제목을 주로 검토를 하고, 논문의 질을 평가하게 된다. 초록의 경우 논문의 질을 가장 쉽게 평가할 수 있으며, 자료의 중요성과 신뢰성을 확인할 수 있다. 특히, 결과의 영향(impact) 혹은 임상적 유용성과 대중의 관심도를 확인할 수 있기 때문에 논문의 질을 평가하는 가장 중요한 요소가 된다. 스크리닝이 끝난 논문은 적절한 편집자 선정 이후에 외부 심사를 거쳐 수정/보완하는 단계를 거쳐 출판 가능한 상태가 된다. 일반적인 국제 저널의 경우, 제출되는 논문 수수는 매년 1000편이 넘기 때문에 외부 심사의 과정이 논문이 제안될 가능성이 매우 높다고 볼 수 있다.

저널에서 진행하는 심사는 연구결과의 감사도 있지만 주된 목적은 올바른, 신랄한 연구로 지도하고, 가치 있는 논문을 만드는 것이 목적이다. 가치 있는 논문을 살려야만 저널의 마케팅이 성공적으로 이루어지고, 영향력도 높아질 수 있다는 것이다. 심사위원은 논문의 수준을 평가하고 수정이 필요한 부분을 지적하는 등 논문을 향상 비판적인 시각으로 평가하는 경향을 가지고 있다. 저자로서 나의 논문이 인정받지 못하는 것은 불쾌할 수 있다. 하지만, 논문 게재는 우수한 논문 중에서 내가 제출한 논문이 저널에 의해 'Pick up'되는 과정이며, 논문 심사 과정은 편집자 및 심사자가 연구자와 함께 고민하면서 훌륭한 논문을 더 훌륭하게 만들여 나가는 과정이라는 것을 항상 염두에 두어야 한다.
Physiologic Changes in Post–Cardiac Arrest Syndrome

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Kyung Woon Jeung

The mortality associated with survival from cardiac arrest still remains significant despite recent advances in post-cardiac arrest care [1]. Although whole body ischemia caused by arrest itself initially causes global tissue injury, additional injury occurs due to complex pathophysiological process after reperfusion, which has been termed as post-cardiac arrest syndrome. Post-cardiac arrest syndrome consists of 4 key components; (1) post-cardiac arrest brain injury, (2) post-cardiac arrest myocardial dysfunction, (3) systemic ischemia/reperfusion response, and (4) persistent precipitating pathology, according to 2008 ILCOR consensus statement [2]. We will review each component of post-cardiac arrest syndrome with relevant experimental and clinical studies.

The pathophysiology of post-cardiac arrest syndrome is very complex and remains partially understood. In brief, brain injury is initially triggered by cardiac arrest, but many injury pathways including excitotoxicity, abnormal calcium homeostasis, free radical formation, pathological protease cascades, and activation of cell death signaling pathways, are executed over hours to days after restoration of spontaneous circulation [3–5]. Global myocardial dysfunction, characterized by low cardiac index, occurs after restoration of spontaneous circulation, and this phenomenon is known to be transient and reversible [6]. Restoration of spontaneous circulation after prolonged cardiac arrest also induces the formation of oxygen radical species and inhibits cellular respiration, resulting in endothelial injury and activation of various systemic inflammatory responses. Increased inflammatory cytokine induces activation of coagulation system, and the activated coagulation system can result in microvascular thrombosis. Adrenal gland function can also be affected particularly after prolonged arrest. All these changes are known to be very similar to those observed in severe sepsis, and contribute to the development of multiple organ failure.

REFERENCES

Resuscitation of a cardiac arrest victim does not end with return of spontaneous circulation (ROSC). Recently, several guidelines recommended a comprehensive, goal-directed post cardiac arrest care to optimize survival and neurologic recovery [1,2].

Early initiation of targeted temperature management (TTM) is critical and should not be delayed. TTM is the active control of systemic body temperature to limit tissue injury after ischemia-reperfusion conditions occurring from cardiac arrest. Current recommendations are to keep all comatose (ie, lack of meaningful response to verbal commands) patients at a constant target temperature between 32~36°C [2]. It is reasonable that TTM be maintained for at least 24 hours after achieving target temperature. However, routine prehospital cooling of patients after ROSC with rapid infusion of cold intravenous fluids is not recommended. It may be reasonable to actively prevent fever in comatose patients after TTM.

A 12-lead electrocardiogram (ECG) should be obtained as soon as possible after ROSC to determine whether acute ST elevation is present. Coronary angiography is recommended to perform emergently (rather than later in the hospital stay or not at all) for out-of-hospital cardiac arrest patients with suspected cardiac etiology and ST elevation on ECG. Immediate coronary angiography and percutaneous coronary intervention in such patients is supported by the American College of Cardiology [3].

Episodes of hypotension after resuscitation are associated with death and poor neurologic recovery in post-arrest patients. Unless precluded by severe myocardial stunning and frank cardiogenic shock, a MAP of 80 mmHg or greater is desirable. Volume replacement should occur with isotonic fluids (hypotonic fluids can exacerbate cerebral edema) and a bedside assessment of volume status. There is no evidence demonstrating the superiority of any one vasopressor after cardiac arrest.

Post-cardiac arrest hyperoxia (PaO₂ >300 mmHg) is associated with higher inpatient mortality than normoxia [4]. These studies speculate that high oxygen concentrations increase oxidative free radical damage. A multicenter cohort study found a linear, dose-dependent relationship between levels of oxygen tension and inpatient mortality, but could not identify a single threshold for harm [5]. In the absence of evidence to support a specific PaO₂ goal for patients, it is reasonable to titrate FiO₂ to the lowest values sufficient to maintain normal arterial oxyhemoglobin saturation (94~98%). As in traumatic brain injury, hyperventilation and hyperventilation result in dysfunctional cerebral perfusion, so it is best to ventilate with a goal of normocarbia (PaCO₂ of 35~45 mmHg).

Increased serum glucose is common after cardiac arrest and is associated with poor outcome, but hyperglycemia may be simply a marker of greater illness severity. After cardiac arrest, there was no difference in outcome when moderate glucose was targeted (108~144 mg/dL) vs strict lower range (72~108 mg/dL) [6]. However, the incidence of hypoglycemic events was higher in the strict vs moderate control group. So, treatment of glucose levels of greater than 180 mg/dL is reasonable.

In conclusion, titrated resuscitation to specific targets is a reasonable approach to the management of the post cardiac arrest [7].

References


Prognostication after Cardiac Arrest

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개 요

심정지 후 성공적인 심폐소생술로 혼수상태인 환자의 예후는 불량하다. 저체온 치료(Therapeutic Hypothermia)의 도입과 중환자 치료의 발전으로 뇌 손상이 최소화된 환자 수가 증가했지만 신경학적 결과를 평가하는 것은 여전히 어려운 문제이다. 특히, 저체온 치료도중 필수적으로 사용되는 진정요법은 신경학적 검사 결과를 신뢰할 수 없게 하고, 운동 반응 회복을 지연시킬 수 있기 때문에 예후 판정에 있어 주의를 요한다. 전기생리학적 검사, 심전영상검사 및 Biomarker등은 이러한 환자의 뇌손상 범위를 평가하는 데 도움이 될 수 있다. 심정지 환자의 신경학적 예후를 예측할 수 있어 예후예측자가 가져야 하는 가장 중요한 점은 0%의 위양성률(False positive rate, FPR)을 갖는 것이이다. FPR에 지대한 영향을 미치는 진정요법 및 신경근육차단제의 효과가 배제되어야 하며, 이에 따라 미국심장협회에서는 저체온 치료를 시행받은 환자와 저체온 치료를 시행받지 않은 환자의 예후 예측을 구별하여 권고하고 있다. 이 장에서는 저체온 치료를 시행 받은 환자의 예후예측에 관하여 알아보도록 한다.

결 론

심정지 후 저체온 치료를 시행 받은 환자의 예후 예측은 매우 어려우며 현재까지 정확한 예측방법은 없다. 신경학적 검사가 기본적이면서도 가장 중요하며, 이를 위해 진정제 및 신경근육차단제의 효과가 반드시 고려되어야 한다. 신경학적 검사와 더불어 여러 modality를 조합하여 환자의 예후를 평가할 것을 권유한다.

<table>
<thead>
<tr>
<th>Modality</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Best Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/Ex. (PLR, Corneal)</td>
<td>Universal availability</td>
<td>Influenced by drugs (sedative, NMBs)</td>
<td>72hrs after ROSC</td>
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<tr>
<td></td>
<td>Easy to perform</td>
<td>Not objective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>First line of information</td>
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<tr>
<td>NSE</td>
<td>Best objective finding</td>
<td>No clear cut-off value</td>
<td>48-72hrs after ROSC</td>
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<tr>
<td></td>
<td></td>
<td>Hemolysis, measuring technique</td>
<td></td>
</tr>
<tr>
<td>SSEP</td>
<td>Simple, inexpensive, bed-side)</td>
<td>Appropriate skill and experience</td>
<td>≥ 24hrs after ROSC</td>
</tr>
<tr>
<td></td>
<td>Not-influenced by drug</td>
<td>Electrical interference, artefacts</td>
<td></td>
</tr>
<tr>
<td>eEEG</td>
<td>Bed-side</td>
<td>Expensive, influenced by drug</td>
<td>≥ 72hrs after ROSC</td>
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<td></td>
<td></td>
<td>No universal definition</td>
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<tr>
<td>aEEG</td>
<td>Bed-side, Inexpensive</td>
<td>Influenced by drug</td>
<td>≥ 72hrs after ROSC</td>
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<tr>
<td></td>
<td>Easy to interpreter</td>
<td>Limited channel</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>Not influenced by drug</td>
<td>Not bed-side (Unstable Pt.)</td>
<td>Within 24hrs after ROSC</td>
</tr>
<tr>
<td></td>
<td>Detect intracranial abnormality</td>
<td>No clear cut-off value (G/W ratio)</td>
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<td></td>
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<td>Maybe subjective</td>
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<tr>
<td>DW-MRI</td>
<td>Not influenced by drugs</td>
<td>Not bed-side (Unstable Pt.)</td>
<td>2-5days after ROSC</td>
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<tr>
<td></td>
<td>Better spatial definition</td>
<td>No universal definition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identifying ischemic tissue</td>
<td>Difficult to analysis</td>
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표1. 심정지 환자의 신경학적 예후를 예측하기 위한 각 modality의 장단점
April 28 (Saturday), 2018

Hall A (HANRA 1+2), 3F
- SY11 / ARDS 1 (Simultaneous Interpretation to English)
  Chairperson: Young Joo Lee (Ewha Womans University, Korea)
- SY12 / ARDS 2 (Simultaneous Interpretation to English)
  Chairperson: Heung Bum Lee (Chonbuk National University, Korea)
- SY13 / Critical Care Nutrition (Simultaneous Interpretation to English)
  Chairperson: Ji-Young Sul (Chungnam National University, Korea)
- SY14 / Pain, agitation and delirium in ICU (Simultaneous Interpretation to English)
  Chairperson: Dong Chan Kim (Chonbuk National University, Korea)

Hall B (HANRA 3), 3F
- SY15 / Special Lectures 2 (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Chairat Permpikul (Mahidol University, Thailand), Jong Heon Jun (Hanyang University, Korea)
- SY16 / ECMO 1: Practical Review (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Mathieu Schmidt (Universite Pierre et Marie, France), Sang Bum Hong (University of Ulsan, Korea)
- SY17 / Sepsis 3 (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Jerry Zimmerman (Washington University, USA), Younsuck Koh (University of Ulsan, Korea)
- SY18 / Sepsis 4 (Language: English) (Simultaneous Interpretation to Korean)
  Chairpersons: Masaji Nishimura (Tokushima Prefecture Central Hospital, Japan), Sung Jin Hong (The Catholic University of Korea, Korea)

Hall C (SHILLA 1+2+3), 3F
- SY19 / Thrombosis and thromboembolism in the ICU 1
  Chairperson: Won-Il Choi (Keimyung University, Korea)
- SY20 / Thrombosis and thromboembolism in the ICU 2
  Chairperson: Won Yeon Lee (Yonsei University, Korea)
- SY21 / Critical Care Nursing
  Chairperson: Jungyeon Kim (Severance Hospital, Korea)
- SY22 / QI Cases in the ICU
  Chairperson: Miyoung Shim (Seoul National University Hospital, Korea)

Hall D (BAEKJE 2+3+4), 4F
- SY23 / Toxicology
  Chairperson: Sung Woo Lee (Korea University, Korea)
- SY24 / The Beginning Era of Surgical Intensivist : Acute Care Surgeon
  Chairperson: Nam Ryeol Kim (Korea University, Korea)
- SY25 / Infection Control in the ICU
  Chairperson: Young Sam Kim (Yonsei University, Korea)
- SY26 / ECMO 2: Special Considerations
  Chairperson: Ki Ick Sung (Sungkyunkwan University, Korea)

Hall E (GOGURYEO 1+2+3), 5F
- SY27 / Perspective of Stroke management
  Chairperson: Sang Hyung Lee (Seoul National University, Korea)
- SY28 / Clinical applications of Critical care ultrasound
  Chairperson: Youngrook Ha (Bundang Jesaeng Hospital, Korea)
- SY29 / Neurromonitoring and therapeutic approach in Neurological Critical Care Unit
  Chairperson: Sung Hee Hwang (Hallym University, Korea)
- SY30 / Updated Korean guidelines in critical care medicine
  Chairperson: Won-II Choi (Keimyung University, Korea)
Early Recognition of Acute Respiratory Distress Syndrome

Seoul National University, Korea

Yeon Joo Lee

Acute respiratory distress syndrome (ARDS) is characterized by life-threatening hypoxemia with high mortality. Research focusing on preventing ARDS and identifying patients at risk of developing ARDS is necessary to develop strategies to alter the clinical course and progression of the disease. To date, few strategies have shown clear benefits. One of the most important obstacles to preventive interventions is the difficulty of identifying patients likely to develop ARDS.

The lung injury prediction score (LIPS) identifies patients who are unlikely to develop ARDS. This was demonstrated by a prospective cohort study of 5584 patients, in which seven percent of the cohort developed ARDS, resulting in a negative predictive value (ie, the percent of patients with a LIPS <4 who will not develop ARDS) of 97 percent. A LIPS >4 predicted ARDS with a sensitivity and specificity of 69 and 78 percent, respectively.

Identifying a biomarker that predicts the development of ARDS or progression of severity could be helpful. Unfortunately, no single biomarker is currently specific or sensitive enough to be incorporated into routine clinical practice. Bos et al. conducted two studies where they discriminated between mechanically ventilated patients with and without ARDS on the basis of a breathprint obtained by analyzing exhaled air through eNose technology. This breathprint distinguished between patients with ARDS and those without as accurately as PaO2/FiO2 assessment. However, further studies are needed before this approach can be incorporated into routine clinical practice. Other biomarkers in plasma or bronchoalveolar lavage fluid have been studied in patients with ARDS. A recent trial in critically ill patients demonstrated that higher levels in plasma of angiopoietin-2 were significantly associated with increased development of ALI (odds ratio (OR) 2.4; 95% CI 1.3-4.2). Because there is no ideal biomarker to help us in the early detection of ARDS, the association between biomarkers and different scoring systems based on clinical data or diagnostic tests could improve prediction scores.

The search for genetic variants determining susceptibility and predicting outcome is still a developing field. Studies that link mutations in the surfactant protein B (SP-B) gene to an increased risk of ARDS support this notion. Insertion-deletion polymorphisms associated with the angiotensin converting enzyme (ACE) gene have also been suggested as a possible risk factor for ARDS. Animal studies have indicated that SOD3 gene knockout mice had higher susceptibility to ALI induced by lipopolysaccharides (LPS) and stronger response to pulmonary inflammation. Nevertheless, at present, we cannot identify a single gene responsible for a high susceptibility to ARDS. Research on the gene polymorphism of ARDS is currently in the preclinical stage and the results are not consistent. These studies could help to define new therapeutic targets, new approaches to treatment and individual indicators of predisposition to developing the disease that might enable the development of effective preventive strategies.
Early Ambulation or Physiotherapy in ARDS

Department of Critical Care Medicine, Samsung Medical Center

Chi Ryang Chung

There are growing interest and concern about post-discharge outcomes of acute respiratory distress syndrome (ARDS) survivors because aging population and recent advances in critical care have led to increase in the number of these survivors. ARDS survivors suffer from various complications after discharge, including physical, cognitive and mental health impairments, those collectively called as post-intensive care syndrome (PICS). Moreover, studies of long-term recovery after critical illness demonstrated that profound physical disability persists for a considerable period of time in some patients. Against these devastating complications, prior studies suggested rehabilitation as an important management strategy. They have demonstrated not only feasibility and safety, but also the benefits of rehabilitation, including improvement of physical function, reduced delirium, and reduced duration of mechanical ventilation and length of stay. In addition, in the survivors of respiratory failure requiring mechanical ventilation, lack of early ICU mobility therapy was associated with hospital readmission or death within 12 months of hospital discharge. Although a recent meta-analysis did not demonstrate differences in mortality, impacts of ICU rehabilitation on mobility status, muscle strength and days alive and out of hospital were observed.

Despite the growing evidence base for early rehabilitation, a number of recent studies have disclosed levels of rehabilitation within critical care to be low, particularly patients are treating mechanical ventilation. The cause of this lack of physiotherapy has become a source of much interest, with findings suggesting the causes are multifactorial and vary between nations, regions or even ICUs within the same hospital. A number of perceived barriers to early mobilisation in the ICU are related to the safety of such activities, questioning the risks and potential for harm in mobilising patients who by their very nature are critically ill. The use of customized protocols for mobilisation may have a number of beneficial effects, helping to guide initiation and identify patients who are deemed sufficiently haemodynamically stable and ready to start more active mobilisation. And multidisciplinary rounds provide team members with the opportunity to discuss the patients' rehabilitation in the context of medical stability, any current plan for weaning of sedation and respiratory support, management of delirium and to highlight other team member tasks which may require completion.

To better understanding of the trajectory of recovery after ARDS, we are learning how critical illness affects the life after ICU survival. For the rehabilitation as a routine practice and the consequent outcome improvement, overall consideration should be given to factors related with physicians or specific healthcare systems as well as previously presented barriers.
Right Heart Failure in Acute Respiratory Distress Syndrome

Division of Pulmonary and Critical Care Medicine, Departments of Medicine and Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine

Kyeongman Jeon

Acute respiratory distress syndrome (ARDS) is the most severe form of acute respiratory failure characterized by diffuse alveolar damage, and is associated with poor clinical outcomes, with a pooled mortality rate of approximately 40% despite best standards of care. Current therapeutic strategies are based on improving oxygenation and pulmonary compliance while minimizing ventilator-induced lung injury. However, cardiac failure, in particular right heart failure (HF), is commonly encountered in moderate to severe ARDS and is reported to be one of the major determinants of mortality. In this brief review, the epidemiology of right HF in ARDS and its effect on clinical outcomes, the current state of knowledge of the pathophysiology of right HF, diagnosis of acute right HF in ARDS, and managements of right HF including preventive and therapeutic strategies will be discussed.

There are various definitions for right ventricle (RV) dysfunction and failure in the literature, with the terms being used interchangeably at times. Acute cor pulmonale (ACP) refers to acute dilatation or dysfunction (or both) of the RV in the context of acute lung disease and associated pulmonary vascular dysfunction. ACP is a form of RV dysfunction that is due to an acute increase in RV afterload that may lead to RV failure. For a long time, intensivists considered that ACP was only a marker of severity and had no direct impact on prognosis. However, it has been shown that ACP has a negative impact on the course of ARDS and that severe right HF is associated with increased mortality even during lung-protective mechanical ventilation, although there is no robust evidence to support a definitive causal relationship between ACP and mortality in ARDS. The prevalence rate of right HF in ARDS varies across studies with different criteria, ranging from 20% to 60%. Since the wide spread of the lung protective ventilator strategy, the incidence of ACP has dramatically fallen. Whereas the reported incidence of ACP in the 1990s was very high (around 60%) in patients ventilated with high tidal volume, many studies in patients on protective mechanical ventilation have reported an incidence of 20% to 25% in the most recent studies of ARDS patients. Nevertheless, the prevalence of ACP remains high and risk factors have not been determined precisely.

RV is responsible for maintaining adequate pulmonary perfusion pressure to deliver desaturated mixed venous blood to the respiratory membrane and low systemic venous pressure to prevent organ congestion. The RV is sensitive to changes in afterload because it is anatomically adapted for the generation of low-pressure perfusion. The following mechanisms have been suggested to play a crucial role in the development of ACP in ARDS:

- ARDS affects not only alveoli but also the pulmonary circulation. This is due to inflammation, vasoconstriction, edema, thrombi, and vascular remodeling leading to increased pulmonary vascular resistance.
- Positive-pressure mechanical ventilation causes an increase in transpulmonary pressure, which acts as a back pressure for pulmonary venous return and may increase RV afterload.
- Permissive hypercapnia may also have a role to play by causing hypercapnic vasoconstriction in ARDS.

It might be expected that early diagnosis of right HF would be of benefit; however, diagnostic strategies used to prospectively evaluate the RV in ARDS have not well been tested. Since the first ultrasound description of RV dysfunction in situations other than ARDS, the diagnosis of ACP has relied on critical care echocardiography. The diagnosis of ACP combines echocardiographic patterns of RV volume overload, also called diastolic dysfunction, and of RV pressure overload, also called systolic dysfunction. To summarize, the diagnosis of ACP is a qualitative echocardiographic one combining RV dilatation with paradoxical septal motion. In addition, limited data exist on the role of B-type natriuretic peptide in the prognostication of patients with ARDS with RV dysfunction. In contrast, a recent study looking at patients with moderate to severe ARDS demonstrated that an ele-
vated troponin level, in conjunction with echocardiographic findings of RV dysfunction, identified a high risk subgroup with elevated mortality.

The treatment of ACP can be divided into several physiological targets, including optimizing RV preload, increasing RV contractility, and reducing RV afterload. Meticulous management of volume status is crucial for a failing RV, as both low and high filling pressures may result in reduced cardiac output. Appropriate heart rates and rhythms can be the simplest method of improving RV contractility. Initiation of vasoactive support can be important not only in improving RV contractility but also in preventing hemodynamic instability. Reducing RV afterload in patients with ARDS with ACP can be achieved through the use of pulmonary vasodilators, reversal and control of precipitating factors (hypoxemia, hypercapnia, acidemia, hypothermia), and RV protective mechanical ventilation strategies. The main proposed components of the RV protective ventilation strategy include (1) minimizing lung stress by limiting plateau and driving pressures, (2) prevention or reversal of pulmonary vaso-constriction by improving oxygenation and strict CO₂ control, and (3) prone positioning to unload RV. Extracorporeal life support can theoretically reverse physiological causes of ACP and facilitate the RV protective ventilation. In addition, venoarterial extracorporeal membrane oxygenation can enhance unloading of the failing RV.

In summary, although there is no definitive causal relationship between right HF and mortality, severe right HF is associated with increased mortality in patients with ARDS. Factors that can adversely affect RV function include hypoxic pulmonary vaso-constriction, hypercapnia, and invasive ventilation with high driving pressure. Understanding the pathophysiology of RV dysfunction in ARDS is crucial for the bedside management of these patients. RV now appears as a key factor in adapting the ventilatory strategy in patients with ARDS.

References

Spontaneous Breathing during Mechanical Ventilation: Benefits and Harms

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Chae-Man Lim

Mechanical respiration is inevitable in patients with respiratory failure from any causes. However, with the proposition that the spontaneous breathing should be restored as soon as possible, the weaning process is essentially a period of mixed mechanical breathing and spontaneous breathing. Spontaneous breathing in patients requiring ventilatory assistance has advantages and disadvantages of its own. First, in terms of gas exchange, spontaneous breathing can improve ventilation-perfusion ratio compared to mechanical breathing. When the diaphragm is activated, the amount of ventilation to the gravitational dependence portion, which is also rich in lung perfusion, also increases. In addition, recent studies have shown that the diaphragm functions as a kind of braking force against dependent atelectasis that may occur during expiration. It is known that sigh, a phenomenon of spontaneous breathing, also has the effect of homogenizing alveolar dynamic heterogeneity. From the viewpoint of respiratory mechanics, spontaneous breathing during the period of mechanical ventilation can reduce the degree of diaphragmatic dysfunction induced by mechanical ventilation. However, spontaneous respiration is not necessarily beneficial when lung injury is severe, such as ARDS. Excessive ventilation, especially at an early stage, can amplify ventilator-induced lung injury in the lung parenchyma. It is known that if the patient’s spontaneous breathing is allowed in the early stage of mechanical ventilation, the pressure in the thoracic cavity becomes augmented and the damage is increased by unequal lung expansion. In addition, negative intrathoracic pressure during spontaneous breathing can promote pulmonary edema through increased permeability capillaries in an ARDS lung.
Lung Protective Ventilation Strategy in ARDS

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Je Hyeong Kim

After first description of acute respiratory distress syndrome (ARDS)\(^1\), there was enormous development in intensive care medicine. In spite of this development, it has been reported that hospital mortality in severe ARDS was 46.1\(^2\). The majority of deaths of ARDS patients is attributable to multiple organ dysfunction syndrome (MODS) rather than primary respiratory failure. This phenomenon is due to the ventilator-induced lung injury (VILI). VILI is the additional inflammatory damage caused by mechanical ventilation, especially in ARDS. VILI plays a pivotal role in the initiation and/or propagation of a systemic inflammatory response that leads to MODS in majority of patients

The fundamental cause of development of VILI is the heterogeneity in acute lung inflammation. In ARDS lung, severe inflammation with consolidation and/or atelectasis is present in the dependent part, but the non-dependent part is relatively normal. If mechanical ventilation with traditional high tidal volume without positive end-expiratory pressure (PEEP) is applied, non-dependent part of the lung is damaged by physical stretch injury and dependent part of the lung is injured by shearing force caused by the reopening and collapse of alveoli.

Lung protective ventilation (LPV) strategy is measures to prevent VILI. In a broad sense, LPV strategy includes low tidal volume ventilation, high PEEP, prone position ventilation, and alveolar recruitment maneuver. In a narrow sense, only low tidal volume ventilation and high PEEP are included. Low tidal volume ventilation is to prevent physical stretch injury. High PEEP is the measure to decrease the injuries from shearing force. Prone position ventilation and recruitment maneuver are to increase homogeneity of the ARDS lung, resulting in decrease in development of VILI.

The clinical support is strongest for low tidal volume ventilation\(^3,4\), which should be used in all cases of ARDS. Tidal volume of 4-8 mL/Kg of predicted body weight and plateau pressure of lower than 30 cmH\(_2\)O are recommended\(^5\). However, there are many controversies in other strategies. High PEEP showed only improvement of oxygenation without reduction in mortality in large-scaled clinical trials. However, in systematic review and meta-analysis, hospital and ICU mortalities of higher PEEP group were significantly reduced in patients with \(\text{PaO}_2/\text{FiO}_2 \leq 200 \text{mmHg}\), suggesting to consider application of higher PEEP in (moderate to) severe ARDS patients.

Several factors, including pressure, volume, and cyclic opening and closure of the lung units, have been recognized as possible triggers in the development of VILI, and different approaches were performed to each trigger. Recently, there were efforts to define parameters that can reflect the “functional” size of the lung, and one of them is driving pressure (DP, plateau pressure-extrinsic PEEP). In an analysis with multilevel mediation analysis of previous studies, reductions in DP were significantly associated with better survival of ARDS patients\(^7\). Clinical trials need to be designed in which ventilator changes are linked to achieve changes in DP, in order to determine whether the result of an analysis can be translated into changes that may be implemented at the bedside.

References

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Prone Position and Recruitment Maneuver in ARDS

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So Young Park

Prone position (PP) has been used since the 1970s to treat severe hypoxemia in patients with acute respiratory distress syndrome (ARDS). Several mechanisms have been proposed to account for this effect, including an increase in end-expiratory lung volume, better ventilation-perfusion matching, and regional changes in ventilation associated with alterations in chest-wall mechanics. The final result of PP is that the overall lung inflation is more homogeneous from dorsal to ventral than in the supine position, with more homogeneously distributed stress and strain. Over 40 years of clinical trials have consistently reported improved oxygenation in approximately 70% of subjects with ARDS. Early initiation of PP is more likely to improve oxygenation than initiation during the subacute phase. Maximal oxygenation improvement occurs over a wide time frame ranging from several hours to several days. 5 years ago, Guérin C proved that in patients with severe ARDS, early application of prolonged prone-positioning sessions significantly decreased 28-day and 90-day mortality. Meta-analyses of randomized controlled trials suggest that PP provides a survival advantage only in patients with relatively severe ARDS (PaO2/FIO2 <150 mm Hg). Moreover, survival is enhanced when patients are managed with a smaller tidal volume (<6 mL/kg), higher PEEP (10–13 cm H2O), and longer duration of PP sessions (>10–12 h/session). Recently, Yoshida etc suggested continuous negative abdominal pressure (CNAP) could recruit dorsal atelectasis in experimental lung injury, and that oxygenation improved at different transpulmonary pressure values compared with increases in airway pressure in porcine model of lung injury (surfactant depletion followed by ventilator-induced lung injury). Compared with prone position without CNAP, CNAP in the supine position was associated with higher PaO2 and compliance, as well as greater homogeneity of ventilation. The mechanism of action of CNAP appears to be via selective narrowing of the vertical gradient of Ppl. CNAP appears to offer physiological advantage over prone positioning. Further trials are required to confirm benefit from CNAP in human.

The rationale for the use of recruitment maneuvers (RMs) in ARDS is to promote alveolar recruitment, leading to an increased end-expiratory lung volume and thus decreased ventilator-induced lung injury (VILI). RMs consists of a transient increase in transpulmonary pressure that can re-open previously collapsed alveoli. RMs represents a physiological response to lung aggression in different conditions by re-opening the collapsed part of the lung and decreasing lung edema. This process can be accomplished through a variety of methods. Identifying ARDS patients who may benefit from RMs is a major issue, depending essentially on the amount of recruitable lung involved. Therefore, the bedside use of thoracic electrical impedance tomography (EIT) in patients with ARDS may be a key auxiliary tool for ARM by enabling clinicians to choose an optimal PEEP for maximum recruitment after considering key variables, including pulmonary static compliance (Cst), recruitable alveolar collapse and alveolar overdistension. However, the effect of RM on clinical outcomes has not been well established. Recently there were two systemic review through meta-analysis. However, the two analysis showed different view. In the Hodgson C’s analysis, a ventilation strategy that included recruitment maneuvers in participants with ARDS reduced intensive care unit mortality without increasing the risk of barotrauma but had no effect on 28-day and hospital mortality. In another review, Goligher etc suggested a significant mortality reduction (six trials; RR, 0.81;95% CI, 0.69–0.95; evidence grade =moderate), and the use of a higher PEEP co-intervention did not significantly modify the mortality effect (P = 0.27 for heterogeneity). LRMWs were also associated with improved oxygenation after 24 hours (six trials; mean increase, 52 mm Hg; 95% CI, 23–81 mm Hg) and less frequent requirement for rescue therapy (three trials; RR, 0.65; 95% CI, 0.45–0.94). LRMWs were not associated with an increased rate of barotrauma (four trials; RR, 0.84; 95% CI, 0.46–1.55). In this analysis, randomized trials suggest that LRMWs in combination with a higher PEEP ven-
tilation strategy reduce mortality. Recently, the Alveolar Recruitment for ARDS trial (ART) was conducted to assess whether a strategy of lung recruitment maneuver associated with PEEP titrated according to the best respiratory-system compliance vs a well-established low-PEEP strategy improves clinical outcomes. In patients with moderate to severe ARDS, a strategy with lung recruitment and titrated PEEP compared with low PEEP increased 28-day all-cause mortality of patients with moderate to severe ARDS. However, confidence in this findings is limited. Further trials are required to confirm benefit from LRMs in adults with ARDS.

References

Glutamine -Pro-

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Glutamine serves as a primary fuel for rapidly dividing cells, such as in the gut and immune system, and is used as a source of nitrogen to refill the citric acid cycle [1-3]. During critical illness, the demand for glutamine may exceed that which can be mobilized from muscle stores. These metabolic impairments limit the function of key tissues and cells, in particular that of the immune system, as well as the cellular mechanisms of stress response (Figure 1) [4].

Clinical data over the past 20 years have provided evidence that glutamine supplementation may reduce mortality, the occurrence of infections and hospital length of stay in such patients. Routine glutamine supplementation has long been recommended for critically ill patients receiving parenteral nutrition (PN) [5, 6]. Numerous clinical trials and meta-analyses indicate that counteracting glutamine deficiency helps to normalize metabolism and, most importantly, improves outcome [7, 8]. Recently, this scientifically sound recommendation has been questioned, [9, 10] primarily based on the controversial findings from a large multicenter study published in 2013 [11–13] which caused considerable uncertainty amongst clinicians.

However, suitable candidates for intravenous glutamine include, in particular, critically ill patients with burns, trauma, or malignancies. Although glutamine is contraindicated in patients with severe renal and/or hepatic insufficiency, it is generally safe in patients with failures of other organs (e.g., brain damage or respiratory failure receiving adequate mechanical ventilation or gastrointestinal failure) with re-compensated circulatory shock and resolved metabolic acidosis as well as normal substrate utilization.

References

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Glutamine in the ICU: Cons

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Jae-Myeong Lee

In the critical care management, previously reported benefits of glutamine, selenium and immunonutrition with arginine seem to have vanished over time. Nowadays, many reports suggest not to use these specific nutritional treatment for the critically ill patients.

Glutamine may become depleted, especially in the setting of critical illness with increase metabolic demand and protein catabolism. And low level of serum glutamine seem to be associated with increased mortality in critical illness. Therefore, correcting the deficient state seems to be logically a better target than over supplementing non-deficient patients.

However, contrary to our expectation, critical illness is not necessarily associated with a low serum glutamine level. One study reported that only 31% of patients in the intensive care unit (ICU) presented with a low baseline serum glutamine level (<420 μmol/L). They even investigated elevated baseline serum glutamine level in 174 patients with multi-organ failure, and a value of > 930 μmol/L was actually associated with increased mortality. (1) And we know well the result of REDOX (Reducing Deaths due to Oxidative Stress) study. For sure, any patients in multi-organ failure in the ICU should not receive glutamine regardless of whether he or she is receiving parenteral nutrition.

In the nutritional guidelines for critically ill patients from SCCM / ASPEN in 2016, they suggest not to add enteral glutamine to an EN regimen routinely in critically ill patients (moderate power) and not to use parenteral glutamine routinely (moderate power). In their meta-analysis, enteral glutamine seemed to be associated with low mortality only in burn patients and parenteral glutamine seemed to be associated with only decreased ventilator apply days and ICU stay days. (2)

We need larger multicenter studies to look at the benefits of glutamine replacement in deficient glutamine states in ICU populations. And furthermore, these studies also should powered to detect potential adverse effects of glutamine.

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Selenium has been focused on its role on critically ill patients including sepsis or septic shock. It has been expected to be a magic bullet in intensive care based on its antioxidant defense effect. Through incorporation into selenoproteins as the amino acid, selenocysteine, Selenium has both immune-modulatory and anti-inflammatory effects.

Since critical illness is characterized by oxidative stress, Selenium is regarded as one of the most promising antioxidants. Especially in severe sepsis or septic shock, oxidative stress and mitochondrial dysfunction is known to be a key component. Recent studies demonstrated that decreased level of serum Selenium concentration is inversely correlated to clinical outcomes. Also majority of randomized controlled trials showed that high-dose intravenous Selenium administration leads to reductions in infectious complications and mortality rates in critically ill patients.

Nonetheless, after introduction of recent large randomized trials including REDOXS and SISPCT trials, the clinical guidelines including the ASPEN/SCCM and the Canadian Clinical Practice Guidelines do not recommend Selenium supplementation any more in septic patients. Therefore in this session, it is quite invaluable to discuss the basic rationale and to find the clinical evidences of potential clinical benefit of Selenium therapy for critically ill patients.
The pathogenesis of sepsis involves microbial infection, inflammation, and immune disorders. Patients with sepsis have oxidative stress that may contribute to multi-organ failure and death. Selenium (Se) is an essential trace element with anti-inflammatory and immunomodulatory properties, and it is considered the cornerstone of the antioxidant defense system. Recently, selenium has been extensively applied in clinical practice.

Low plasma selenium levels were associated with low plasma glutathione peroxidase (GSH-Px) activity and high mortality in critically ill patients. Intravenous administration of Se has been proposed as adjunctive sepsis therapy since it restores activity of glutathione peroxidase, attenuates oxidative stress, and may improve survival. Over the last two decades, researchers in several randomized clinical trials (RCTs) have evaluated the role of parenteral inorganic seleno-compounds such as sodium selenite or selenious acid and have shown beneficial results in terms of reduction of infections, mortality, and other relevant clinical outcomes in the critically ill. However, the REducing Deaths due to Oxidative Stress (REDOXS) trail investigators were unable to find a therapeutic benefit of a combined Se supplementation regimen (300 μg enteral plus 500 μg parenteral). The most recent and largest RCT on Se monotherapy in severe sepsis and septic shock, the Sodium Selenite and Procalcitonin Guided Antimicrobial Therapy in Severe Sepsis (SISPCT) study, further demonstrated that high-dose IV sodium selenite was not associated with improved survival. In addition, the updated systematic review and meta-analysis, which included the two largest recent RCT, of the effects of parenteral Se as single or combined therapy on clinical outcomes was unable to demonstrate any effect of IV Se supplementation on mortality or any significant effect on infections, ventilator days, or ICU and hospital length of stay.

IV Se therapy cannot be recommended for routine clinical use in critically ill patients. The current understanding of why there is a lack of therapeutic effect IV Se therapy in critically ill patients and patients with sepsis remains unclear. So, we suggest that we need to go back to basics and obtain more pharmacokinetic and pharmacodynamic data in specific patient populations with specific dosing strategies.

**Keywords:** Parenteral selenium, Intravenous selenium, Antioxidant micronutrient, sepsis
Neurological Examination of Critically Ill Patients

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Jung-Ah Lim

Neurological complications are common and important contributor to morbidity and mortality in the critical care setting. The identification of neurologic impairment is often delayed due to administration of sedative and neuromuscular-blocking agents. However, brief and focused neurologic examination including responses to graded stimulus, brainstem evaluation, motor responses and respiratory pattern provides valuable information. Along with core neurological examination, history, daily sedation interruption, additional neuroradiologic and neurophysiologic evaluation allow for diagnosis and treatment of neurological complications.
Despite expanding knowledge of the physiologic effects of pain, availability of dependable tools for pain assessment, and evidence-based guidelines for analgesic management, pain is common and often undertreated in critically ill patients. Many critically ill patients experience pain due to underlying illness or injury, a recent surgical or other invasive procedure, or noxious stimuli caused by interventions in the intensive care unit (ICU). In this brief review, the physiology, assessment, and treatment of pain in the critical care setting will be discussed.

Pain is sensed through the afferent pain pathway. Recent tissue damage due to illness, injury, or surgery initiates the release of local inflammatory mediators, which may cause primary hyperalgesia (augmented sensitivity to painful stimuli) or allodynia (misperception of pain with stimuli that are not noxious). Therefore, analgesic agents are used to reduce pain by altering perception of pain in the central nervous system (eg, opioid analgesics, acetaminophen) and inhibiting local production of pain mediators (eg, NSAIDs).

Underestimation and undertreatment of pain are common in the critical care setting, although not all critically ill patients have pain. Intubated semi-conscious patients may be unable to communicate that they have pain. Even patients who are conscious and interactive have variable abilities to express their need for pain control. For patients who can communicate, pain assessment tools include patient questionnaires and visual scales. For patients who lack the ability to communicate, behavioral reactions and facial expressions can be used as a surrogate method of patient evaluation and assessment of pain. If a patient is oversedated, the patient may not appear to be in pain, however, despite being unconscious their bodies are still experiencing the stress response triggered by pain signaling. There are several tools that have been designed for critically ill patients to help adequately evaluate pain in a standardized manner. The Behavioral Pain Scale (BPS) uses facial expression, upper limb movement and compliance with ventilation as a means of evaluating pain in the ICU. The Critical-Care Pain Observation Tool (CPOT) evaluates facial expressions, movements, muscle tension and ventilator compliance to determine a pain score. The CPOT and BPS use both pain-related behaviors and physiologic indicators, have excellent validity and reliability, and are recommended in the Society of Critical Care Medicine (SCCM) Pain Agitation and Delirium (PAD) guidelines.

The primary goal of analgesia is to provide optimal patient comfort. This goal is patient-specific and depends upon the clinical situation, individual patient tolerance of pain, and side effects of analgesic therapy. Some patients prefer to tolerate a certain pain level in order to maintain alertness, whereas others do not. In critically ill patients, alleviation of pain is predominantly accomplished with analgesic drugs that alter central mechanisms. An ideal drug would have a rapid onset, rapid recovery, lack of drug accumulation, and no side effects or toxicity. No single agent has all of these characteristics. Therefore, a multimodal approach is often employed. This approach may include opioid analgesics, nonopioid analgesics, regional anesthesia, and other adjuncts, and can be individualized based on the specific source and severity of pain in the patient. Potential advantages of a multimodal approach include improved analgesia; effective analgesia with lower opioid doses; and decreased risk of opioid-related side effects or eventual development of tolerance, withdrawal symptoms, or opioid-induced hyperalgesia. Although multimodal approaches improve outcomes for perioperative patients, however, limited data are available regarding outcomes in critically ill patients.

For most patients in ICU, including mechanically ventilated patients, intravenous opioids are a first-line treatment for non-neuropathic pain. In some critically ill patients who are able to communicate and have only mild to moderate pain, nonopioid analgesics may be adequate without opioid supplementation. Selection of a specific intravenous opioid agent as the mainstay of
pain control in a critically ill patient depends upon the desired onset and duration of analgesic action, as well as potential adverse effects of the agent. If administered in equivalent analgesic doses, there are no differences among different opioid agents in analgesic efficacy. However, pharmacokinetics, metabolism, and side effects vary considerably. Comparative advantages and disadvantages and typical dosage regimens of each opioid will be described during my presentation. The roles of nonopioid analgesics, sedatives, anxiolytics, and antipsychotics in critically ill patients will be also described. Since opioids are not well tolerated or necessary in all critically ill patients, one or more intravenous nonopioid analgesic agents are frequently employed as primary therapy for pain control or as part of a multimodal approach. Adding these agents may allow reduction or elimination of opioids and opioid-related adverse effects.

In summary, critically ill patients may experience pain due to underlying illness or injury, recent surgery, or noxious stimuli. Underestimation and undertreatment of pain are common in this setting. Maintenance of acceptable individualized level of comfort requires routine frequent pain assessments that document severity, response to medication, and development of side effects.

Intravenous opioids are used as first-line treatment of non-neuropathic pain for most critically ill patients. Opioid dosing may be reduced or eliminated by use of one or more intravenous nonopioid analgesic agents.

References

Postoperative Delirium: Perioperative Risk Management

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Delirium is an acute state of confusion defined by fluctuating mental status, inattention, and either disorganized thinking or an altered level of consciousness. Emergence from anesthetic care is often accompanied by signs of delirium and agitation, including fluctuating mental status and inattention. Card et al.1 showed that delirium signs were present in up to 31%, and in 4% at discharge from PACU. Perioperative delirium (POD) is a frequent complication after major surgery especially in elderly patients. A retrospective study of 242 elderly patients underwent hip surgery showed 116 (48%) of the 242 patients developed perioperative delirium during their stay in the hospital.2 Delirium was associated with longer hospital stay and increased medical cost. Delirium also contributes to increased mortality, prolonged duration of mechanical ventilation and post-traumatic stress disorder.3,4

A prospective cohort study enrolling 275 consecutive mechanically ventilated patients showed that 51 (18.5%) had persistent coma and died in the hospital.5 Among the remaining 224 patients, 183 (81.7%) developed delirium at some point during the ICU stay. Patients who developed delirium had higher 6-month mortality rates (34% vs 15%, P =.03) and longer hospital stay than those who never developed delirium (P<.001). Delirium was independently associated with higher 6-month mortality (adjusted hazard ratio [HR], 3.2; 95% confidence interval [CI], 1.4-7.7; P =.008), and longer hospital stay (adjusted HR, 2.0; 95% CI, 1.4-3.0; P<.001).

1. Diagnosis

The fifth edition of the Diagnostic and Statistical Manual (DSM-5) highlighted the feature of delirium, putting a focus on reduced awareness and inattention.6

(1) Impairment of attention and lack of awareness to the environment.
(2) Rapid and fluctuating course.
(3) Change in at least one cognitive domain (recent memory, orientation, language, or perceptual disturbance). Associated with sleep disturbance, emotional fluctuation, and worsening of symptoms in the evening.

For intubated patient, the two most widely used delirium assessment tools are the Intensive Care Delirium Screening Checklist (ICDSC) and the Confusion Assessment Method for Intensive Care Unit (CAMICU).7

2. Subtypes of Delirium

Sedation level or psychomotoric state is usually assessed with the Richmond Agitation Sedation scale (RASS).

(1) Hyperactive delirium
(2) Hypoactive delirium
(3) Mixed type

Hypoactive delirium occurs more often comparing to hyperactive form.

3. Risk Factors of POD

Predisposing risk factors are generally long-standing patient characteristics, whereas precipitating factors can be considered as acute triggers (table 1).8
Table 1. Precipitating and Predisposing Factors

<table>
<thead>
<tr>
<th>Predisposing Factors</th>
<th>Precipitating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Urgent surgery</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>Perioperative IABP</td>
</tr>
<tr>
<td>Dementia</td>
<td>Intercurrent Cx</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
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<tr>
<td>Prior postoperative delirium</td>
<td>Metabolic derangement</td>
</tr>
<tr>
<td>Previous stroke</td>
<td>Shock, Dehydration, anemia</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>Prolonged pain</td>
</tr>
<tr>
<td>Functional impairment</td>
<td>Low perfusion pressure</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>Hyposia</td>
</tr>
<tr>
<td>Drugs*</td>
<td>Valve surgery</td>
</tr>
<tr>
<td>EUROscore</td>
<td>Duration of CPB or surgery</td>
</tr>
<tr>
<td>Cardiac output</td>
<td>Drugs*</td>
</tr>
<tr>
<td>Preoperative atrial fibrillation</td>
<td>Perioperative blood transfusion</td>
</tr>
<tr>
<td>Poor nutritional status</td>
<td>SIRS/sepsis</td>
</tr>
<tr>
<td></td>
<td>Infection</td>
</tr>
<tr>
<td></td>
<td>Intraoperative hemofiltration</td>
</tr>
</tbody>
</table>

4. Prevention

(1) Orientation and activity intervention
(2) Early mobilization
(3) Visual and hearing aid
(4) Sleep enhancement
(5) Correct precipitating factors: hypoxemia, hypotension, anemia, malnutrition, stop unnecessary sedation or drugs

References

Compassionate and Evidence-Based Palliative and End-of-Life Care in the Intensive Care Unit

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While many patients admitted to intensive care units (ICUs) survive and return to an acceptable quality of life, there will always be a group of ICU patients who die in the ICU or shortly after ICU discharge.

Evidence also supports that ICU survivors may suffer negative physical and/or psychological side effects for months to years following critical illness. Further research also suggests that family members of ICU patients – both survivors and decedents – may have negative psychological and social side effects related to their loved one’s critical illness. Thus, ICU clinicians must be able to provide skilled and compassionate palliative and end-of-life care for patients and their family members.

Palliative care is a medical subspecialty that optimizes patient and family quality of life, regardless of diagnosis or disease prognosis. Palliative care involves: (1) advanced symptom management, (2) psychosocial support of families, and (3) expert communication regarding patient and family medical goals and preferences for medical treatments. Palliative care can be provided by fellowship-trained specialists and/or non-trained, frontline, primary clinicians. Palliative care is often provided at the same time as other medical treatments. Palliative care is different from hospice and end-of-life care. Finally, there is an increasing body of evidence supporting that palliative care in the ICU can improve multiple outcomes for critically ill patients and their family members.

This session will:

- Define palliative care and discuss the evidence base surrounding palliative care, particularly ICU-based palliative care.
- Differentiate between palliative care, hospice care, and end-of-life care.
- Discuss palliative care practices that ICU clinicians can use to improve communication and family-centered care among critically ill patients and their family members.
- Distinguish palliative care practices that ICU clinicians can use to optimize compassionate care for patients dying in the ICU and their family members.
Skeletal muscle weakness and physical disability are common in critically ill patients. After ICU admission the muscles of mechanically ventilated critically ill patients rapidly atrophy; during intensive care, noticeable reduction in muscle mass and attendant functional disabilities start within 3 days and progressively worsen thereafter. Decreased muscle mass is associated with prolonged weaning from mechanical ventilation, length of ICU stay, and higher mortality.

Skeletal muscle weakness is usually assessed by manual muscle testing (MMT) to grade the strength of different muscles to alert and cognitively responsive patients. Ultrasonography is non-invasive and easily available at the bedside, and a useful tool for evaluating muscle atrophy regardless of patient consciousness. Typically, ultrasonographic assessment of muscle mass is carried out on lower limbs. Ultrasonography assessment revealed, within 10 days admission, lower-limb muscle mass of intensive care patients decreases by 18%–30%.

Published data for upper-limb muscle atrophy seems contrary to expectations. One recent study has found, while lower-limb muscle mass decreased, upper-limb muscle mass remained unchanged throughout the first 10 days of ICU admission. Another study, of healthy volunteers who underwent a five-week period of bed rest, reported that muscle thickness decreased in the lower limbs, but not in the upper limbs. Healthy volunteers used their arms actively during bed rest, and it may have counteracted the tendency to atrophy. Measurement protocols may also be attributable to the disparity between our results and previous studies. Nakanishi et al. investigated both upper and lower limb by ultrasonography and reported both upper and lower limbs wasted equally in critically ill patients.

Lower muscle atrophy absolutely gets in the way of daily life as might be expected. Upper limb atrophy also disturbs daily life, such as bringing a spoon to mouth, brushing teeth, and writing. It is prudent to monitor upper-limb muscle atrophy as well as lower-limb muscle atrophy.
Telemedicine Applied to Intensive Care – Tele-ICU Update

Johns Hopkins School of Medicine, USA

Adam Sapirstein

Telemedicine has a long history of association and has developed in parallel with many quality improvement methods in intensive care medicine. Tele-ICU has been proposed as a solution to problems of ICU staffing, quality, and process control.

This talk will address the application and deployment of tele-ICU systems and place these systems in the larger context of the ICU care model. Data on the effectiveness and costs of tele-ICU implementations will be reviewed. In particular, we will discuss lessons learned from a small controlled study at Johns Hopkins Hospital. Because overnight intensivist staffing is often considered an alternative to tele-ICU we will also review its effectiveness.

In spite of 20 years of experimentation and examination the value of tele-ICU systems remains a source of debate. Technical and economic factors will continue to impact the development of ICU surveillance systems. As a result tele-ICU centers are likely to undergo significant changes in form and function.
Implementation of Multidisciplinary ECMO Team

Chiba University, Japan

Shigeo Oda

Extracorporeal membrane oxygenation (ECMO) is a life-saving procedure for severe cardiac and respiratory failure. Recently, indication of ECMO has been extended to variety of patients, including not only cardiogenic shock and acute respiratory distress syndrome (ARDS), but also cardiac arrest and septic shock. The number of patients treated with ECMO has been increasing.

In Japan, ECMO has been mainly developed as circulatory support for patients with cardiogenic shock or cardiac arrest, as so-called extracorporeal cardiopulmonary resuscitation (E-CPR). Recently, the effect of ECMO treatment for severe respiratory failure caused by H1N1 influenza pandemics has been reported. Respiratory ECMO has been paid worldwide attention. However, experience of long term ECMO for respiratory failure has been scarce in our ICU.

To achieve better clinical outcomes in patients treated with ECMO, well-coordinated multidisciplinary team specialized in ECMO has reportedly been effective. Therefore, we established multidisciplinary ECMO team on October 2013 after visiting overseas institutions of excellence for ECMO. Our ECMO team consists of emergency and critical care physicians, cardiologist, ER and ICU nurses and ICU dedicated clinical engineers.

ECMO team first establish the new ECMO system equipped with various monitoring enabling long term treatment. Then, they created the manual and training system for prompt implementation and safe maintenance of ECMO. They also created database of ECMO patients and started to join the ELSO registry. Training programs for staffs, including lectures, water drills, simulation scenario for trouble shooting were developed, and finally nationwide training program for ECMO, “ECMO Simulation Lab” was established. Currently, ECMO team had a role of conducting procedures and management of ECMO, training staffs and data collection.

After establishment of ECMO team, number of patients treated with ECMO, especially patients with respiratory failure has been increasing. Long run ECMO and awake ECMO for respiratory failure were achieved. Recently, patient equipped with ECMO has been successfully transferred to another institution for lung transplantation by ECMO team. Although outcome of ECMO patients has not significantly improved yet, development of ECMO team greatly contributed to the quality improvement of ECMO treatment in our ICU.
Extracorporeal carbon dioxide removal (ECCO₂R) is a technique providing artificial respiratory support by removal of CO₂ from blood through an extracorporeal gas exchanger and is a feature of several strategies of extracorporeal life support (ECLS), including venovenous (VV) and arteriovenous (AV) extracorporeal membrane oxygenation (ECMO). However, low flow VV devices which provide CO₂ removal, but not oxygenation, are emerging as a potential respiratory support strategy. Although originally developed as means to improve the respiratory management of patients with ARDS, advances in technology and a better knowledge of the technique have enabled its use in other clinical syndromes, such as severe asthma or decompensated chronic obstructive pulmonary disease (COPD) and bridge to transplantation.

Mechanical ventilation, the mainstay treatment for ARDS, carries the risk of several adverse effects, the most important being ventilator-induced lung injury (VILI). This secondary lung injury contributes to the release of inflammatory mediators, which may negatively affect extrapulmonary organ function. Lung protective ventilatory strategies have been demonstrated to improve patient outcomes. Nevertheless, recent studies have shown that even applying protective mechanical ventilation, lung injury may still occur. Further reductions in ventilation intensity (i.e., tidal volumes, airway pressures) may limit VILI further, potentially decreasing mortality. This potential benefit of limiting VILI further has resulted in a growing interest in ECCO₂R as an adjuvant strategy in patients with ARDS.

A number of relatively small, proof of concept studies has demonstrated the safety and feasibility of ECCO₂R to facilitate "ultra"-protective mechanical ventilation. A systematic review of 14 studies (495 patients) confirmed that ECCO₂R is feasible, facilitates the use of lower tidal volume ventilation, and was associated with an increased number of ventilator-free days but not improved survival.

ECCO₂R appears to be a promising adjunct to ventilatory management in patients with ARDS that has the potential to minimize VILI. More information will be available from the results of a recently completed international multicenter pilot study (SUPEROVA; ClinicalTrials.gov NCT02282657) to assess the safety and feasibility of mechanical ventilation at 4 mL/kg PBW (facilitated by ECCO₂R), and an ongoing UK multicenter randomized controlled trial comparing ECCO₂R to enable lower tidal volume ventilation versus standard care (REST; ClinicalTrials.gov NCT02654327). Until then, given the observational nature of most of available clinical data and differences in technical features and performances of used devices, it is difficult to understand the balance of risks and benefits for or against ECCO₂R in patients with ARDS. Therefore, ECCO₂R should be considered an experimental technique rather than an accepted therapeutic strategy.

Reference

Over the past decade, intensive care unit (ICU) and hospital survival of immunocompromised patients have gradually improved. Although mortality remains high compared to the general population of critically ill patients, especially when associated with mechanical ventilation, those patients are increasingly admitted to ICUs. Concurrently, successful extracorporeal membrane oxygenation (ECMO) support of the most severe acute respiratory distress syndrome (ARDS) cases, as shown for the recent influenza A(H1N1) pandemic or, in the randomized CESAR trial, led to a steep increase of the number of venovenous (VV)-ECMO procedures performed over the past decade. Thus, the reported encouraging hospital and long-term survival rates of immunocompromised patients in ICUs means those patients are more likely to receive invasive therapies, like ECMO. Indeed, 19% to 31% of ECMO-treated ARDS patients in recently published cohorts were immunocompromised. Although, the negative impact of immunosuppression on survival of ARDS-patients— with or without ECMO—has been constantly emphasized, their prognosis and ECMO-related complications have not yet been thoroughly examined. To date, data available on this specific population were mainly described in single-center cohort study that usually included small numbers of patients. Based on a cohort of 203 severely ill, ECMO-treated, immunocompromised patients, extracted from an international multicenter, retrospective cohort, 6-month overall survival was only 30% with significantly worse outcomes for patients with hematological malignancies. Notably, <30 days between immunodeficiency diagnosis and ECMO cannulation was independently associated with better 6-month survival, while higher PaCO₂, age and driving pressure, and lower pre-ECMO platelet count were associated with 6-month mortality.
An Extracorporeal Blood Cleansing Device in Sepsis Models

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Joo Hun Kang

Sepsis is a major cause of deaths of patients in state-of-the-art hospital intensive care units, affecting about 750,000 Americans each year. Pathogens, including bacteria, fungi, and viruses, which have invaded the bloodstream, activate a systematic immune response that often leads to death when the pathogen load is significantly high or the immune system is depressed. We have previously reported the development of microfluidic blood cleansing devices for use in sepsis therapy; however, their flow throughput capacity was not practical for clinical use. Here we describe an improved biospleen device that can remove pathogens and endotoxins from septic blood flowing at high rates and clearance efficiencies without knowing the pathogen type. This was accomplished using magnetic nanoparticles coated with a generic opsonin—Mannose Binding Lectin (MBL)—that binds various bacteria, fungi, viruses and endotoxin, and by designing a microfluidic configuration that mimics the microarchitecture and cleansing function of the human spleen.

We engineered the biospleen device using computational simulation programs, which allowed us to optimize flow conditions for magnetic separation of pathogens from blood. The core parts of the microfluidic device were fabricated using hot-embossed medical grade polycarbonate materials; the outer surfaces of the machined parts were then bonded with a thin (125 μm) layer of transparent polycarbonate film. The engineered MBL opsonin was produced and immobilized on magnetic nanoparticles (128 nm) to capture a variety of pathogens and endotoxin without pre-identifying the pathogens. To determine the functionality of the device, we spiked various types of pathogens into human whole blood anticoagulated with heparin (1.5 U/mL), and then flowed the blood samples through the device. Blood-cleansing efficiencies were quantified using blood cultures and ELISA.

When anticoagulated human blood was flowed through the biospleen device at 1.25 L/hr for 26 hr, we did not observe any evidence of blood clotting or coagulation. We then confirmed that the biospleen device can remove a variety of pathogens, including C. albicans, E. coli, S. aureus, and mixtures of gut flora isolated from the cecum of rats, with clearance efficiencies consistently over 90% when flowing at rates of 10 to 1000 mL/hr. To provide proof-of-concept for our blood cleansing device therapy, we carried out testing in rats. Blood is drawn from a rat infected with pathogens or endotoxin via a jugular catheter at a flow rate of 10 mL/hr, and is continuously mixed with magnetic nanobeads coated with FcMBL. The blood and magnetic opsonins are then flowed through an in-line mixer to promote bead binding, and into millimeter-sized fluidic channels of the magnetic separator unit of the biospleen device. Stationary magnets pull the magnetically opsonized pathogens and toxins from the blood through sinusoid-like slits, and into a parallel saline channel; the cleansed blood is then returned back to the rat. The biospleen treatment significantly reduced pathogen levels in blood and lung of rats infected with S. aureus.

References


Keywords: sepsis; bacteremia; mannose binding lectin; blood cleansing device; magnetic separation
Mitochondria in Sepsis

Kiichi Nakahira

Sepsis is caused by a deregulated host response to infection, and remains as a major public health concern with high mortality and morbidity. Inflammatory responses observed in sepsis are important for host defense against invading microbes, however the excessive inflammation often causes severe tissue damage and organ dysfunction, leading to death. Although traditional inflammatory/immune molecules such as TNF-α or IL-6 ended up with unfavorable outcomes in clinical trials or biomarker studies, inflammation remains a key pathogenesis of sepsis.

Emerging studies suggest that new inflammatory pathways and their associated molecules are implicated in the pathogenesis of preclinical models of sepsis. The inflammasome is a molecular platform that promotes cleavage of caspase-1, a crucial molecule for maturation and secretion of pro-inflammatory cytokines, such as IL-1β and IL-18 in immune cells (1). The nucleotide-binding domain, leucine-rich repeat-containing receptor, pyrin domain-containing-3 (NLRP3) inflammasome senses pathogen-associated molecular patterns (PAMPs) and damage-associated molecular patterns (DAMPs) such as ATP and DNA (1). Inflammasome has been shown to be implicated in a wide range of diseases such as infection, cancer, metabolic diseases, and neurodegenerative diseases (1).

To date, mitochondria have been extensively studied as critical cellular organelles for energy generation, protein synthesis, catabolism, and cell death. However, there has been a growing interest in mitochondria as an important regulator of various immune responses, and mitochondria have been shown as major sources of DAMPs (2, 3). Our studies demonstrated that mitochondria are critically implicated in inflammasome-mediated immune responses. When cells receive inflammatory stimuli or infection, mitochondrial function can be de-regulated and cause mitochondrial reactive oxygen species (ROS) generation and mitochondrial membrane potential transition (4). These abnormal mitochondria tend to release mitochondrial DNA (mtDNA) into cytosol, and further promote the secretion of IL-1β and IL-18 (4). These results imply that loss of mitochondrial integrity triggers release of mtDNA which can act as mitochondrial DAMPs.

Subsequent our studies elucidate that mitochondria-associated metabolic pathways such as glycolysis and lipid metabolism promote NLRP3 inflammasome activation. For example, knock-down of uncoupling protein-2 (UCP2) and NADPH oxidase 4 (NOX4), critical mitochondria-associated molecules for lipid synthesis and free fatty acid oxidation respectively, suppresses NLRP3 inflammasome activation in macrophages (5, 6). Mice lacking UCP2 and NOX4 reduce susceptibility to cecal ligation and puncture induced sepsis and Streptococcus pneumoniae infection (5, 6). Taken together, our recent studies suggest that mitochondria are critical cellular organelles for immune responses, inflammation and pathogenesis of sepsis.

In human studies we have shown that the plasma levels of inflammasome-associated molecules such as IL-18 and mtDNA are associated with the disease severity and mortality of critically-ill patients including sepsis (7, 8), and furthermore that altered metabolic profiles may identify a signature of clinical sepsis (9). These reports and findings suggest that inflammasome associated molecules and mitochondrial DAMPs are implicated in the pathogenesis of human sepsis. More importantly, molecules such as mtDNA, inflammasome-associated cytokine IL-18, and other metabolites can be potentially useful biomarkers to predict disease severity and mortality of patients with sepsis.

Given a dreadful disease state such as sepsis with limited availability of useful biomarkers and therapy, and enormous unmet medical need, it remains urgent to develop useful biomarkers for sepsis, which may also lead to identifying potential therapeutic targets of sepsis.
References


Sepsis is defined as life-threatening organ dysfunction caused by dysregulated host response to infection. In addition, the new definition proposed that quick SOFA criteria (i.e. alteration in mental status, systolic blood pressure ≤ 100 mmHg, or respiratory rate ≥ 22 bpm) should be used in general wards to identify patients with suspected infection who are likely to develop sepsis. Many investigators have then validated the superiority of qSOFA criteria to SIRS criteria with regards to prognostic accuracy under different settings, such as ICU, emergency department, and general wards. However, as a screening tool for sepsis, the value of qSOFA score is to prompt clinicians to further investigate for organ dysfunction, thereby confirming or ruling out the diagnosis of sepsis. As a result, the diagnostic accuracy of qSOFA to identify patients with sepsis-3, especially when used longitudinally with repeated measurements throughout the hospital stay, may be more demanding than its prognostic accuracy. Two systematic reviews and meta-analyses published recently concluded that qSOFA criteria had a significantly lower sensitivity of diagnosing sepsis or infection-induced acute organ dysfunction than SIRS criteria, based on retrospective cohort studies. In a prospective cohort study of 4045 patients in general wards of a university hospital, we identified 409 patients with infection, who were then followed up for up to 28 days for daily qSOFA criteria and twice-weekly SOFA score. Of these 409 patients, 229 met the sepsis-3 criteria, whereas 146 and 371 met the qSOFA and SIRS criteria, respectively. Compared with maximal SIRS score, maximal qSOFA score exhibited a lower sensitivity (0.53 vs. 0.98) and a higher specificity (0.87 vs 0.18). Although these findings await further validation in multicenter studies, they suggest that SIRS score might better serve as a screening tool to prompt clinicians to further investigate for sepsis workup and/or organ dysfunction, whereas qSOFA score should be considered as a trigger of initial resuscitation and empirical antibiotic therapy, in order to avoid delay in treatment, especially in patients at higher risk of clinical deterioration.
Sepsis is one of the most common causes of death in critically ill patients in non-coronary intensive care units. The main characteristic of sepsis is systemic vasodilation, with frequently absolute hypovolemia. Hemodynamic management of severe sepsis and septic shock, including rapid restoration of intravascular volume and adequate balance between systemic oxygen delivery and demand, is very important. Resuscitation with isotonic fluid (Ringer's lactate or normal saline [0.9% NaCl]) is the current standard of care and often involves the administration of several liters of fluid to restore microvascular perfusion. The infusion of several liters of crystalloid solution is associated with the adverse effect of extravasation into the interstitial space because only one quarter of the infused amount remains in the intravascular space with the remaining 3 quarters distributed into the extravascular space resulting in only a transient increase in plasma volume. However, the routine use of colloid solutions for the resuscitation of a patient with septic shock is not recommended since it has shown similar outcomes (at 28 days) with crystalloid or colloid fluid that was administered.

Therefore, the use of alternative types of fluids for the resuscitation of a patient with septic shock was proposed. Hypertonic saline is one choice of fluid. The beneficial effects of hypertonic saline were first described by Velasco and colleagues in the treatment of hemorrhagic shock. Several studies have shown that hypertonic saline applied in hemorrhagic shock can rapidly increase the plasma osmotic pressure, facilitate the rapid return of interstitial fluid into the blood vessels, and restore the effective circulating blood volume. In addition to its beneficial hemodynamic properties, hypertonic saline recently has been demonstrated to have significant anti-inflammatory effects. *In vitro* hyperosmotic conditions have been demonstrated to reduce the production of pro-inflammatory cytokines and augment the counter-inflammatory response by macrophages. Furthermore, in vivo models of hemorrhagic shock have demonstrated that hypertonic saline inhibits tumor necrosis factor-α expression and increases interleukin(IL)-10 production by alveolar macrophage. Hypertonic saline is therefore thought to protect organs following shock resuscitation by modulating the critical balance between pro- and anti-inflammatory reactions of immune cells.

However, few studies have demonstrated that hypertonic saline treatment increases the survival rate in animals with sepsis/septic shock. Since hypertonic saline resuscitation has been reported to restore hemodynamic variables, inhibit neutrophil-endothelial cell overinteraction, and modulate the balance between pro- and anti-inflammatory reactions, we investigated the beneficial effects of hypertonic saline on the circulatory failure and multiple organ dysfunction syndrome (MODS) caused by a polymicrobial sepsis model in rats and to evaluate what possible mechanisms contribute to its beneficial effects. We found animal treated with cecal ligation and puncture (CLP) for 18 hrs was associated with circulatory failure, MODS, and 18-hr mortality. Hypertonic saline not only ameliorated the deterioration of hemodynamic changes but also attenuated neutrophil infiltration in the lung and the liver of septic animals. Hypertonic saline increased the survival rate at 9 and 18 hrs compared with the CLP group. Moreover, hypertonic saline reduced plasma nitric oxide and interleukin-1β and organ O2·levels in rats that underwent CLP.

In addition, it has been demonstrated that platelet CD40 ligand (CD40L) expression plays an important role in inflammatory conditions; reduction of CD40L expression may be beneficial for patients with sepsis. Although hypertonic saline, mannitol, and hydroxyethyl starch (HES) solutions have been shown to modulate inflammatory responses, their effects on platelet CD40L expression are unclear. In our study, we found resuscitation fluids, such as hypertonic saline, mannitol, and HES, inhibit agonist-induced CD40L expression on platelets obtained from septic pa-
patients, and which is better when they combined each other. These resuscitation fluids may have an anti-inflammatory action when administered to septic patients.

In conclusion, hypertonic saline prevented circulatory failure, alleviated multiple organ dysfunction syndrome, and decreased the mortality rate in animals receiving CLP. These beneficial effects of hypertonic saline may be attributed to reducing the plasma concentration of nitric oxide and interleukin-1β, decreased platelet CD40L expression, as well as the organ O₂ level and decreasing lung neutrophil infiltration and liver necrosis. Our study suggests that hypertonic saline could be a potential and inexpensive therapeutic agent in the early sepsis of animals or patients.

REFERENCES

Carbon Monoxide in the Treatment of Sepsis

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Carbon monoxide (CO), a low-molecular-weight gas, is endogenously produced in the body as a product of heme degradation catalyzed by heme oxygenase (HO) enzymes. As the beneficial roles of HO system have been elucidated in vitro and in vivo, CO itself has also been reported as a potent cytoprotective molecule. Whereas CO represents a toxic inhalation hazard at high concentration, low-dose exogenous CO treatment (250–500 parts per million) demonstrates protective functions including but not limited to the anti-inflammatory and anti-apoptotic effects in preclinical models of human diseases. Of note, CO exposure confers protection in animal models of sepsis by inhibiting inflammatory responses and also enhancing bacterial phagocytosis in leukocytes. These unique functions of CO are mediated by multiple pathways such as autophagy induction or biosynthesis of specialized pro-resolving lipid mediators. We suggest that CO gas may represent a novel therapy for patients with sepsis.

While CO is known as a ubiquitous environmental product of organic combustion process, including the burning of wood, coal, gas, and tobacco, CO is also physiologically produced in cells and tissues as the byproduct of heme catalytic activity of heme oxygenase (HO) enzymes (1-4). HO catalyzes the first and rate-limiting step in the oxidative degradation of heme to ferrous iron, biliverdin-IXa, and CO. In the past two decades, the interest in HO isozymes has shifted from their well-defined metabolic function in heme catabolism and hemoglobin turnover, to their critical physiological function as cytoprotective molecules in numerous models of cellular stress in vitro and in vivo.

With the ever-increasing amount of experimental evidence demonstrating the beneficial roles of HO (1), much interest has been generated by both basic and clinical/translational investigators whether direct administration of such end products may serve as a therapeutic approach in human diseases. Despite the notorious pharmacological effect of CO (i.e., the high affinity for hemoglobin and the resultant displacement of oxygen), many studies have demonstrated the protective roles of inhaled CO (iCO), when administered at low concentration, in various disease models such as hyperoxia induced acute lung injury (ALI) and mechanical ventilation-induced ALI. Importantly low-dose CO inhalation also improves the survival of septic rodents induced by cecal ligation and puncture (CLP), endotoxin, Enterococcus faecalis, or Escherichia coli. Of note, the protective roles of CO on sepsis is not limited to rodent models but also observed in large animal models such as swine and nonhuman primates. Functionally, CO can impact multiple key biological processes including autophagy, mitochondrial biogenesis, programmed cell death (apoptosis), cellular proliferation, inflammation, and innate immune responses. Our recent study shows that CO inhibits NLRP3-mediated inflammasome activation by regulating release of mitochondrial DAMPs (e.g., mitochondrial DNA) (5).

In human, exhaled CO (eCO) has been measured and analyzed in patients as an inflammatory marker of diseases. Interestingly, the levels of eCO are higher in mechanically ventilated septic patients, compared with ventilated patients without sepsis, suggesting the potentially critical roles of CO in septic patients (6). Clinical trials of iCO studies have been rigorously and carefully performed to prove the safety of CO treatment to human. In a recent completed trial of “Inhaled Carbon Monoxide to Treat Idiopathic Pulmonary Fibrosis (NCT01214187)”, iCO at 100–200 ppm was administered two times weekly for 2 h per dose to complete 12 wk of treatment. Although further studies are needed to determine the appropriate dosing and administration schedules to achieve therapeutic concentrations of iCO, importantly no differences in distribution of adverse events were noted between the treatment arms (7). Finally, “Safety Study of Inhaled Carbon Monoxide to Treat Acute Respiratory Distress Syndrome (NCT02425579)” has been recently completed and the full analysis of this trial is pending. The purpose of the trial is to assess the safety of iCO in intubated patients with sepsis-in-
duced ARDS. Since sepsis is still one of the leading causes of ARDS, this clinical trial may provide the critical information how iCO can be efficiently and safely delivered to septic patients.

Although beneficial roles of low-dose CO inhalation are proven in rodent models, the studies of iCO as the treatment for human diseases are at an early phase in the clinical development. Further studies are needed to establish the optimal delivery and dosing protocol for iCO therapy in critically ill patients. Nonetheless, given a dreadful disease state such as sepsis with no effective therapeutic target and enormous unmet medical need, the potent protective molecule CO is hard to be overlooked but should be evaluated for the benefits of patients.

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Sepsis is characterized as a systemic inflammatory response to uncontrolled infection. Generalized vasodilatation and vascular leakage together with depressed cardiac contractility are key physiologic alteration resulted from exaggerated humoral and cellular mediator release. Hypotension is considered as distributive event and resuscitation thus consists of fluid therapy to restore intravascular volume depletion and vasopressors to correct vasodilatation.

The points to be addressed in the talk will be focused on selection, assessment and timing of vasopressors. Norepinephrine (NE) is suggested as the first line agent. When compared with dopamine, use of NE resulted in lower mortality and less complication, namely cardiac arrhythmia. Vasopressin or antidiuretic hormone is introduced lately as low natural level was noted in certain patients. At present, the 2016 Surviving Sepsis Campaign suggests vasopressin in patients who are not responsive to high dose NE. Epinephrine is preserved in refractory shock because of its potent $\alpha$ and $\beta$ stimulant. Its use as a first line agent is not advocated despite of the fact that mortality was less in some studies and the agent is extremely cheap.

Use of vasopressors requires close monitoring. First, macro-circulation target, the mean arterial pressure of 65 mmHg, needs to be frequently assessed. Higher blood pressure offers no additional benefit but more side effects. Tissue perfusion is another important concern since intense vasoconstriction might compromise microcirculation. Moreover, local complication needs to be frequently assessed, especially in those whom NE is given via peripheral vein.

The perfect timing of vasopressors has long been discussed. Evidences supporting early use are accumulating. Recently, our double blind RCT disclosed that the administration of low dose NE during the initiation of resuscitation resulted in higher shock reversal rate at 6 hours, nonsignificant lower mortality and less cardiac complication.

In conclusion, vasopressors are important component in septic shock resuscitation. Clear understanding of current evidences is necessary and more research works are needed in order to maximized patients’ outcomes.
Cytokine Adsorbing Hemofilter for the Treatment of Septic Shock

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Although the definition of sepsis has been changed recently, pathobiology of sepsis remains unchanged. Namely, dysregulated immune response to infection is the main feature of sepsis, and over-produced cytokines play a pivotal role in the development of organ dysfunction or failure in sepsis or septic shock.

After discovery of cytokine adsorption by polymethylmethacrylate (PMMA) membrane hemofilter, we have long been studied on cytokine modulation with continuous hemodiafiltration (CHDF) using cytokine adsorbing hemofilter for the treatment of sepsis or other critical illness caused by so-called hypercytokinemia.

In April 2000, we introduced rapid measurement system of interleukin (IL)-6 blood level in the clinical laboratory of Chiba University Hospital. We measure IL-6 routinely not only for diagnosis of systemic inflammatory response or sepsis, but also for evaluation of severity and treatment effect of cytokine removal. IL-6 was remarkably increased in patient with septic shock and related to outcome of septic patients. In the series of PMMA-CHDF treatment in septic shock patients, we found that significant decrease in IL-6 blood level and blood lactate in conjunction with increase of blood pressure and urine volume. In vitro adsorption study with porcine blood supported substantial removal of various cytokines by PMMA-CHDF.

Recently, another hemofilter which also has cytokine adsorbing property, AN69ST hemofilter, has been introduced in Japan. We conducted the multicenter study to evaluate the effect of AN-69ST CHDF in septic shock patients. AN69ST CHDF treatment significantly improved survival rate compared to conventional treatment. Thus, AN69ST hemofilter was approved to use for patient with septic shock without renal failure. In vitro study revealed that cytokine adsorbing capacity of PMMA and AN69ST hemofilter was compatible, but AN69ST hemofilter has more removal capacity in IL-8 and HMG-B1 than PMMA hemofilter.

Currently, we perform CHDF using cytokine adsorbing hemofilter in patient with sepsis or septic shock when IL-6 blood level exceeds 10,000 pg/mL and blood lactate does not decrease by conventional treatment following sepsis management guidelines. We never use endotoxin adsorption (PMX-DHP) for septic shock. We have treated 140 patients with sepsis including 52 septic shock in 2017, and 28-day survival rate was 83.6% for all sepsis patients and 75% for septic shock. CHDF with cytokine adsorbing hemofilter might be effective as an adjunctive therapy for septic shock.
Virchow’s Triad, first described in 1856, states that there are three contributing factors in the formation of thrombosis: venous stasis, vascular injury, and hypercoagulability. Although venous stasis alone may be insufficient to cause thrombus formation, concurrent presence of venous stasis and vascular injury or hypercoagulability greatly increases the risk for thrombosis [1].

Unlike arterial thrombosis where there is a clear relationship between blood vessel injury and thrombus formation, pathogenesis of venous thrombosis is not clear [2]. Platelets are the core of arterial thrombi along with cellular components closest to the vessel wall, but in venous thrombi fibrin is the substance attaching the thrombus to the vessel wall, with platelets attaching to the fibrin.

Stasis promote endothelial activation, leading to thrombosis. Venous thrombosis occurs usually in areas with decreased or mechanically altered blood flow such as the pockets adjacent to valves in the deep veins of the leg [3]. As blood flow slows and oxygen tension declines there is an increase in hematocrit. The hypercoagulable micro-environment downregulate certain antithrombotic proteins (thrombomodulin and endothelial protein C receptor) and hypoxia drives the expression of certain procoagulants such as P-selectin [4]. Pathogenesis of venous thrombosis is usually complex and multifactorial.

Guidelines from NICE and ACCP recommend direct oral anticoagulants (DOACs) as first line treatment for DVT [5-6]. DOACs include direct factor Xa inhibitors apixaban, rivaroxaban and edoxaban, and a direct thrombin inhibitor, dabigatran. Randomized controlled trials have shown DOACs to be at least as effective as vitamin K antagonists in treating thromboembolic events [7-8]. Warfarin, a vitamin K antagonist, needs frequent monitoring blood tests and has a narrow therapeutic window.

Low molecular weight heparin has a predictable anticoagulation effect and does not require routine monitoring. It is usually recommended in patients with cancer-associated venous thrombosis.

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Epidemiology and Prevention of Venous Thrombosis in Acutely ill Medical Patients

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Venous thrombosis may lead to poor prognosis, longer duration of hospital stay, and preventable cause of hospital death in acutely ill medical patients (1). It is difficult to estimate accurate incidence of venous thrombosis in acute ill medical patients due to a few data for only medical patients separated from surgical patients and the varied definition of clinically meaningful venous thrombosis (2). Most patients with an acute medical illness are at increased risk for venous thrombosis during and following hospital admission (3). One retrospective study of 911 patients with venous thromboembolism reported that the age- and sex-adjusted incidence of venous thromboembolism was more than 130 times greater than among community residents (4). All patients in intensive care units have high risk for venous thrombosis even though prophylactic anticoagulation (5). The risk of venous thrombosis depends on risk factors and the nature of the acute illness in patients. There are the Padua Prediction Score (6), The IMPROVE risk score (7), and the GENEVA risk score (8). Preventive anticoagulation for venous thrombosis requires consideration of bleeding risk and caution at active gastroduodenal ulcer, history of recent bleeding, and low platelet count (< 50,000/microL). The possibility of bleeding in patients can be calculated by IMPROVE Bleeding risk model. For the patients with an acute medical illness who are considered to be at high risk for venous thrombosis and at low risk of bleeding, the use of pharmacologic thromboprophylaxis is recommended rather than mechanical methods or no prophylaxis. The meta-analysis of 36 randomized trials of a mixed population of hospitalized medical patients compared heparin to placebo for the prevention of deep venous thrombosis and pulmonary embolism (9). Both unfractionated heparin and low molecular weight heparin reduced the risk of venous thrombosis and pulmonary embolism (9). However, most studies and a meta-analysis have not been able to show a consistent beneficial effect of thromboprophylaxis on mortality in hospitalized medical patients (10). Unfractionated heparin in patients with renal insufficiency (creatinine clearance < 30mL/min) is used for prophylactic anticoagulations. Low molecular heparin agents are contraindicated in patients with heparin-induced thrombocytopenia. Therefore, the regular monitoring of platelet count should be needed.

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Deep vein thrombosis and pulmonary embolism were included in venous thromboembolism. Venous thromboembolism develops most often in patients who were admitted in intensive care unit. Most venous thromboembolism was easily treated with anticoagulation therapy. However, some patients suffered from hypotension and death due to right ventricular dysfunction and severe pulmonary hypertension [1]. Thus, it is important that patients with venous thromboembolism are early detected and treated. In this section, author focuses on the diagnosis of venous thromboembolism.

Clinical manifestation of venous thromboembolism is not specific to diagnosis. For example, clinical manifestation of pulmonary embolism includes sudden onset of dyspnea, chest pain, tachycardia, and tachypnea. These signs and symptoms are shown in patients with cardiac disease. Thus, other diagnostic tools, such as imaging, clinical probability assessment and D-dimer testing, need to differentiate venous thromboembolism from other diseases. Clinical probability assessment is used to select patients and guide further diagnostic tests. The representative tool in clinical practice to patients with suspected deep vein thrombosis is the Wells’ deep vein thrombosis score [2]. The Wells’ pulmonary embolism and revised Geneva scores are used in patients with suspected pulmonary embolism [3, 4]. These scores have been changed over the years to apply appropriately in clinical field, and these scores still have a good performance [5]. However, these scales cannot safely exclude the diagnosis of venous thromboembolism. To compensate for the disadvantages in these scales, these scales have to be used in combination with D-dimer testing [5, 6]. Patients with normal D-dimer level are excluded in venous thromboembolism with an acceptable rate which less than 1% of patients will be diagnosed with venous thromboembolism in the next 3 months [1]. However, D-dimer testing is neither safe nor efficient to classify venous thromboembolism in some situations, such as in elderly patients. To increase the performance of D-dimer in some situations, an age-adjusted D-dimer threshold was used in patients older than 50 years and the safety of this scale was recently validated in large prospective study about pulmonary embolism [6, 7]. Despite these disadvantages, clinical probability assessment and D-dimer testing are still used to differentiate venous thromboembolism and it reduces the use of invasive tests and medical cost [1].

Imaging tests are important tools to confirm venous thromboembolism. Compression ultrasonography is the preferred method for the diagnosis of deep vein thrombosis and the two approaches of this tool are whole-leg compression ultrasonography (entire deep vein system from the groin to the calf) and limited compression ultrasonography (only the popliteal and femoral vein segments) [8]. Whole-leg compression ultrasonography is completed in about 10-15 min by an expert and allows exclusion of whole leg deep vein thrombosis in a single evaluation. Limited-compression ultrasonography requires less expertise and can be done in about 3-5 min [1]. In patients with an initial normal finding of limited-compression ultrasonography, the examination should be repeated 1 week later to evaluate the propagation of distal thrombosis. Compression ultrasonography is limited in patients with recurrent deep vein thrombosis and additional tests such as CT venography should be considered in these patients [1]. CT pulmonary angiography is the first-line imaging test for pulmonary embolism and has a high sensitivity for pulmonary embolism. Inadequate scans with CT pulmonary angiography are about 0.6-3.0 % [9-11]. CT pulmonary angiography can provide an alternative diagnosis when pulmonary embolism is excluded and can increase the detection of small, sub-segmental pulmonary embolism, which might have a questionable clinical relevance [1, 9-11]. Ventilation-perfusion lung scanning can replace the CT pulmonary angiography in patients with severe renal insufficiency, allergy to contrast medium, and the ones who are pregnant [11]. CT pulmonary angiography is also the preferred
imaging test in patients with suspected recurrent pulmonary embolism [12].

Venous thromboembolism is a common disease accounting for major global morbidity and mortality [1]. Though many modality for the diagnosis of venous thromboembolism have been developed, the optimum diagnostic approach for venous thromboembolism in each clinical situations is not clarified. Suitable combination of modalities can increase the detection rate of venous thromboembolism and decrease the morbidity and mortality of venous thromboembolism.

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Anti-thrombotic Agents and Reversal Agents at ER and ICU

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The actively bleeding anticoagulated patient presenting to the emergency department requires rapid and simultaneous evaluation and treatment that often also necessitates complex coordination of care with multiple specialists. In addition to the basics of supportive care, in select patients reversal of an antithrombotic agent needs to be considered.

Bleeding is especially concerning with the direct oral anticoagulants (DOACs) because antidotes or specific reversal agents for some of the DOACs are lacking. Additionally, routine coagulation tests cannot be used to determine the degree of anticoagulation, making it more challenging to determine when the anticoagulant effect has resolved. Outcomes of DOAC-associated bleeding appear favorable compared with vitamin K antagonists (meta-analysis that included 13 randomized trials: the case-fatality rate for major bleeding was 7.6% in DOAC, compared with 11% in warfarin).

Generally, antithrombotic reversal is indicated whenever the risks of continued antithrombotic effect outweigh the risks of the reversal. In patients with high-risk bleeding, such as intracranial hemorrhage, active gastrointestinal or genitourinary bleeding, pulmonary hemorrhage, severe trauma, or compartment syndrome, the decision to reverse may be more straightforward; this is also the case in patients that require an emergent invasive procedure. Reversal options vary and may include vitamin K, FFP, PCC, rFVIIa, platelets, and desmopressin, among others. In DOAC-associated bleeding, we suggest the use of a specific antidote for dabigatran (Idarucizumab in the 2017 RE-VERSE AD study), an antifibrinolytic agent (tranexamic acid), and/or oral activated charcoal, especially if the last anticoagulant dose was taken in the previous few hours.
Practical Application and Interpretation of Coagulation Test

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Routine coagulation tests such as the prothrombin time (PT), activated partial thromboplastin time (aPTT), are very useful for evaluating patient’s coagulation status and anticoagulant effect monitoring. But, coagulation test results are influenced by various conditions, such as kind of anticoagulants, sampling times, physical and medical conditions of patients. So, it is not easy to interpret the results of routine coagulation tests in clinical settings. The interpretation of coagulation test data from a patient is a comparative decision-making process, that is, a patient’s result is compared to a reference intervals for making diagnostic and/or therapeutic decisions. But, reference ranges of routine coagulation tests are variable and dependent on the laboratory performing tests. For example, reference ranges of aPTT are 25-30 sec (lower limit) to 33-45 sec (upper limit) in university hospitals in Korea. In case of anticoagulant monitoring tests, therapeutic target range of the PT (INR) test for warfarin monitoring is standardized in clinical lab, but, the therapeutic targets of aPTT test which are routinely used for heparin monitoring are various in clinical labs and changed periodically in each labs. Some of reagents in coagulation tests are biologic products, so it is not easy to standardize coagulation tests. The instruments used in coagulation tests have various testing principles and/or different reporting algorithms. So, it could be helpful for clinicians to understand the test procedures, principles and guidelines of coagulation tests in clinical laboratories. Not only routine coagulation tests, but also a lot of special coagulation tests such as anti-Xa test, thromboelastography, PF4 antibody tests (for HIT) are used in clinical field. But, it is not easy to interpret the results, either. I want to review the principles and guidelines of coagulation tests, tips for interpretation of test results with some clinical cases.

References

The mortality rate of massive PE ranges from 18 to 65%. First of all, the rapid correction of physiologic derangements through pulmonary artery reperfusion therapy is required. The optimal care of these patients are uncertain, the suggested treatment modalities are thrombolytic therapy, pulmonary embolectomy, catheter-directed thrombolysis, or their combination. The role of extracorporeal membrane oxygenation (ECMO) for them is uncertain and few data regarding it are known, but ECMO would be promising to improve survival of patients with massive PE as salvage treatment in combination with suggested treatment modality.
Implementation of Multimodal Interventions to Reduce Central Line–Associated Bloodstream Infections in ICU

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Central line-associated bloodstream infections (CLABSIs) in intensive care units (ICUs) result in increased morbidity, prolonged hospitalization and greater healthcare expenditure[1, 2]. CLABSIs may be prevented through proper placement and management of the central line. The CDC’s Healthcare Infection Control Practices Advisory Committee (CDC/HICPAC) recommends evidence-based central line insertion practices which is known to reduce the risk of subsequent central line-associated bloodstream infection[3].

In this presentation, I would like to report improvement in infection control which was conducted in a university-affiliated, tertiary referral hospital with 1786-beds. Five adult ICUs (including medical ICU, surgical ICU, neuro surgical ICU, cardiopulmonary ICU, and emergency ICU) and 2 pediatric ICUs (including neonate ICU, pediatric ICU) were included in this implementation from 2013 to 2017.

To reduce the CLABSI rates in ICU, we firstly consisted multidisciplinary Task Force Team for ICUs and decided many policies for multimodal interventions.

Main interventions included the implementation of central line bundle (insertion and maintenance bundle). The insertion bundle included four components: hand hygiene, maximal sterile barrier precautions, use of 2% chlorhexidine-alcohol for skin preparations (except infant<2 month), and avoidance of the femoral vein as the access site. The maintenance bundle included hand hygiene, proper dressing changes, scrub the hub, and a daily review of catheter necessity.

Additionally, immediate feedback of surveillance data and education for health care workers were conducted and chlorhexidine-transparent gel dressing was used as advanced intervention. Furthermore, we posted a sign for central line free days and commemorated for CLABSI free days (positive feedback) for creating the safety culture and involving of healthcare workers in ICUs. Especially in MICU, we performed daily multidisciplinary team rounding (included ICU doctors, nurses and infection control team members), daily bathing using 2% chlorhexidine and all beds were remodeled into isolation room in September 2017. Most stepwise interventions had been fully implemented in 2017.

Outcome Indicators were defined as incidence rates of CLABSI per 1,000 catheter-days, catheter utilization ratio.

Process indicator was measured using a checklist for the compliance of hand hygiene and central line insertion and maintenance bundle practices.

In adult ICUs, incidence CLABSI was decreased from 4.36 per 1,000 catheter days in 2013 to 2.85 per 1,000 catheter days in 2017. In pediatric ICUs, the incidence rate of CLABSI was decreased from 5.15 per 1,000 catheter days in 2013 to 2.41 per 1,000 catheter days. The quarterly incidence of CLABSI was also decreased.

The overall compliance of all four components of central line insertion bundles was 55.2%. The compliance of each component was as follows: 100% for hand hygiene, 99.6% for the use of CHG, 87.3% for maximal sterile barrier precaution, and 62.2% for optimal site selection.

This implementation of multimodal infection control intervention may reduce the rate of CLABSI in ICUs effectively.

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The environment of the health care setting can be contaminated with infectious agents such as bacteria, virus, and fungi. Contaminated environmental surface has been shown to be a reservoir for infectious agents.

Scientific evidence suggests that environmental contamination plays an important role in the spread of MRSA and VRE. Outbreaks have been brought under control with infection control measures that include enhanced cleaning. The potential for exposure to pathogens is based on the frequency of contact with a contaminated surface and the type of activity involved.

ICU is a high risk place for environmental contamination because of probability of heavy contamination, high potential for exposure, and more susceptible patients.

Environmental infection-control strategies and engineering controls can effectively prevent Healthcare associated infection (HAI) in ICU.

Before discussing surface cleaning, you should basically consider space, facility, moving lines, and ventilation system, and water system. The regulation of medical facilities has been strengthened since the MERS epidemic in 2016. In the case of expansion or reconstruction after 2017, the ICU has been reinforced with a minimum space for 1 bed (15 m²), distance between beds (2 m), and number of isolation beds (1:10). This is the minimum requirements for infection control.

The ventilation system should include temperature / humidity maintenance, air changes per hour (AOH), air pressure (+/-), and filter control.

Routine cleaning is necessary to maintain a standard of cleanliness. The manual includes frequency of cleaning, type of disinfectants, how to clean according to the risk of contamination, and how to manage the cleaning tools.

There are a number of considerations for upgrading existing cleaning methods for effective environmental management

1. Standardization of cleaning methods: frequency according of risk score, process and procedure, management of cleaning tools, and selection of an ideal disinfectant
2. Measure the quality of cleaning: Visual assessment, culture, ATP bioluminescence environmental marking with fluorescent material.
3. Improvement of cleaning method: improvement of cleaning tool (Disinfectant dispenser, microfiber mop, disinfectant wipe etc.), automated dispensing system, Newer technologies involving fogging (e.g., ozone mists, vaporized hydrogen peroxide) or UV-C radiation for room decontamination.

Environmental management to prevent infection is important. However, the facilities of the ICU are not wide enough, the environmental manpower is small, and the goods are also inferior. Investments and improvements are needed to clean the environment. Investments and improvements for environmental management are needed as much as the efforts of medical staff to reduce infection and MDROs.

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Management of MDRO(Multidrug-Resistance Organisms) in ICU

Hee Youn Park

Intensive care units are at the highest risk of medical related infections due to factors such as patient severity, invasive intervention, underlying disease, immune deficiency and nutritional status. It is characterized by a high percentage of multidrug-resistant strains such as MRSA(Methicillin-resistant Staphylococcus aureus), VRE(Vancomycin-resistant Enterococci) and multidrug-resistant gram-negative bacteria. In terms of microbiological resistance, 85.9% of Staphylococcus aureus were resistant to methicillin resistant strains(MRSA), Enterococcus spp. 33.1% were Vancomycin resistant strains(VRE). The percentage of Escherichia coli and Klebsiella pneumoniae resistant to β-lactam antibiotics was 53.7% and 56.3%, respectively. The carbapenem resistance of Pseudomonas aeruginosa and Acinetobacter baumannii were 43.1% and 89.4%, respectively.

From an epidemiological point of view, a multidrug resistant strain is defined as a microorganism resistant to more than one antibiotic. For example, the name of a multidrug-resistant bacterium appears to be resistant to one antibiotic such as MRSA or VRE, but in fact, these pathogens are often resistant to most antibiotics. The multidrug-resistant bacteria that should be cautious in medical institutions are MRSA(Methicillin resistant Staphylococcus aureus), VRE(Vancomycin resistant Enterococci), CRAB(Carbapenem resistant Acinetobacter baumannii), CRPA(Carbapenem resistant Pseudomonas aeruginosa), CRE(Carbapenem resistant Enterobacteriaceae), Extended-Spectrum β-Lactamase(ESBL) Gram-negative bacteria and VI(R)SA(Vancomycin intermediate (resistant) Staphylococcus aureus). Multidrug-resistant bacteria are spread by direct contact with infected patients or medical personnel who have these microorganisms, colonizatoin pressure is the most important determinant for each hospital or ward. In other words, the ward characteristics such as intensive care unit (ICU), which have a relatively high percentage of patients infected with or infected with multi-drug resistant bacteria, facilitate propagation by bacteria. The most important of these mediators is the hand of a healthcare provider, but it is also spread by the hospital environment or equipment. The general principles of preventive management of MDRO include monitoring administrative measures and observations in medical institutions, education on multi-drug resistant bacteria, antibiotic stewardship, infection control precaution to prevent transmission, environmental management and decolonization.

According to the Guideline for the Prevention of Infectious Diseases of the National Institutes of Health, the start of patient isolation is the case of isolating the bacteria from any part of the patient. If possible, isolation of single rooms is recommended and patients with high risk of transmission(diarrhea, Urinary / fecal incontinence and massive respiratory secretions). There is no definite decision on the release of isolation. The infection control practitioner decides on the timing of isolation according to the epidemiology of the strain and the clinical condition of the patient, because there is a case where the infection is repeatedly negative and then again positive. Usually, the test is performed at intervals of 3 days to 1 week in the originally isolated site and in the infectivity test, and the sequestration is released three times or more. If it is difficult to collect specimens from the original site and if it is separated from the blood, carry out only the infectivity test. In the event of a multidrug resistant microbial epidemic, the employee’s hand hygiene and contact care compliance should be enhanced.

The patient is separated from the other patient's hospitalized room, placed outside the isolation room so as to wear contact protection equipment, and removed from the room just before leaving the isolation room. For intensive care units, active surveillance of multidrug-resistant microorganisms should be performed at admission and at intervals of one week. Until the results of active surveillance immediately after admission to hospital are considered, they are regarded as potential multidrug-resistant bacteria and contact attention is applied. Recently, the importance of environmental management for the management of multi-drug resistance infections is emerging. Deep terminal cleaning, area decon-
taminator and UV lamp application are attracting attention. Recent studies have reported that CHG bathing can reduce MRSA and VRE acquisition by 23%, but CHG bathing is less effective than traditional infection control and rapid screening tests. Further discussion is needed as to whether to choose CHG bathing as a method of managing resistant bacteria.

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Family Engagement and Empowerment in the ICU

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In January 2013, The Society of Critical Care Medicine (SCCM) published the Clinical Practice Guidelines for the management of critical care in the intensive care unit. Within the ABCDEF bundle, the F element, Family Engagement and Empowerment, focuses on examining the concept of family presence in the ICU and identifying strategies to create family engagement and empowerment.

Patient-centered care is defined as providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions. Empowering family members with shared decision-making, safety and future care expectations engages them in the patient’s care.

Patients’ experience in ICU may increase stress of patients and families, negatively affect the mental health of Patients in ICU and limit their role. Such experience may be appeared as PTSD (Post Traumatic Syndrome) and PICS (Post Intensive Care Syndrome) after his discharge.

Thus, not only to prevent Stress, PTSD, PICS of Patients and their families and but also to improve the satisfaction of experience of patients and their families, it is focused on providing separated and specialized service for the patients and the families in ICU

QI team is consist of severance hospital multidisciplinary team, medical-surgical, pediatric, neurosurgery ICU’s doctors, nurses, pharmacist, chaplain, respiratory- rehabilitation therapist, nutritionists.

In order to provide the diversified and specialized service for improvement of the families extent of satisfaction, throughout 10 times of meeting from November, 2016 to March, 2018, we have shared the necessity of ICU Diary, written the guideline based upon NOECCN (North of England and Critical Care Network, 2016) guideline and developed form of diary (today’s event, exercise, diet, sleeping, emotional status, plan etc) which has been educated 5 times to the medical staffs.

From October, 2017, under the consent of the families in ICU patients, the ICU diary writing has been begun. In addition, the medical staffs have reinforced guiding ICU with the ICU Diary leaflet, Poster of introduction of ICU entrance and providing video.

As a result, the stress level of the families has decreased from 14.1 point before QI activity, to 12.9 point, the satisfaction point has increased from 27.9 to 28.5, finally and the Anxiety rates has also decreased from 2.2 point to 2.0.

Also the items of not explaining the treatment in advance and stress rates resulting from short length of Visiting time has been decrease and the increase of the satisfaction rates resulting from confidence from patients having best care, and decreased much “very much anxious” rate from 19.4% to 9.5%.

Especially ICU diary experience contributed for ICU multi-disciplinary team to recognize a holistic patient, and motivate the provision of best critical care. And Families was able to know the detailed condition of the patient, and was able to communicate with the patient. Also the satisfaction of ICU Diary highly rated as 3.25 out of 4 points.

In the future, in order to improve the satisfaction of the families and the experience of participation of the families, we are planning to various interventions such as increase the activities of participation of families, provide information for ready to transfer to ward, prevention of delirium, and study for decrease of PICS.

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Improvement of Nurse Knowledge and Effect of Reducing Delirium by Application of CAM–ICU Assessment Tool and Delirium Prevention Activity

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HEE YOUNG CHOI

1. Background Of Activity

Delirium is an acute medical condition characterized by unconsciousness and cognitive changes. The incidence of delirium has been reported to vary from 22% to 87% depending on the subject, and it is known that the incidence is particularly high in the intensive care unit. If delirium occurs in the intensive care unit, the complications such as accidental catheter removal increasing, and the period of ventilator weaning is delayed, leading to an increase in the length of stay of ICU and a lower survival rate. Early detection and prevention of delirium are more important than treatment after delirium appear, considering that it is a disorder that can be recovered as soon as the causative factor is removed.

Recent guidelines recommend that nurses monitor patient delirium by using delirium assessment tools such as the Confusion Assessment Method for ICU (CAM-ICU) regularly in intensive care unit. However only 7.7% of the nurses experienced using of delirium assessment tool, despite of 85.2% of them experienced patient delirium. CAM-ICU is the most widely used tool for evaluating delirium in ICU patients because of its high sensitivity and specificity in many studies.

In order to provide patient safety and high quality nursing care in our ICU, CAM-ICU is applied and combined intervention for delirium prevention aims at early detection and prevention of delirium and improvement of nurse’s knowledge.

2. Problem Analysis and Goals

In this intensive care unit, nurses are not aware of the necessity of delirium assessment and are not aware of the current status and the seriousness of delirium. Also, nurses focus on disease management-oriented nursing, not only the intervention for delirium has a lower priority in nursing practice, but also lack of experience in delirium intervention. And unfamiliar and uncomfortable environment of ICU such as light and noise can cause delirium. These have been shown to interfere with delirium prevention activity.

The aim of activity was the improvement of nurse knowledge and decrease of delirium incidence rate were applied delirium assessment tool in this intensive care unit.

3. Improvement activity (2017.5~2017.8)

First, the nurses with ICU education were instructed to use CAM-ICU, nurses applied CAM-ICU to the patients twice a day, and the charge nurse performed monitoring and feedback to improve the adequacy of the CAM-ICU.

Secondly, for the prevention of delirium, we repeatedly performed time and date, introducing the nurse in charge, and providing eyeglasses and hearing aids. In addition, environmental intervention activities were performed activity by turning off lights(11 pm ~ 5 am), using portable lighting, sleeping eye and ear plugs, adjusting night medication time and reducing noise in intensive care unit. Physical and therapeutic intervention activities were to reduce the use of restraints and to minimize unnecessary drug use.

Last, to promote awareness and knowledge of nurses, a campaign to promote delirium through posters and educational materials was conducted every month.

4. Effect of improvement activities

The incidence of delirium decreased from 25% to 18.5%. After intervention, the rate of delirium assessment (CAM-ICU), adequacy of delirium assessment, nurse delirium knowledge in a
row increased from 95.7% to 98.6%, from 85% to 96.2%, and from 64 to 96 points.

5. Conclusion and management plan

The use of delirium assessment tools and the use of multiple interventions led to an increase in the rate of delirium administration, adequacy, and knowledge of the nurse's delirium. The incidence of delirium also decreased consistently after intervention. This suggests that multiple nursing interventions and educational activities for nurses are effective in preventing delirium. And this intervention with CAM-ICU and preventive check-list for early detection of delirium will be continued.
Let’s Make a Safe PICU with Alarm Management

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Bo-rim LEE

1. Background

Electronic medical devices are a critical part of patient care in intensive care unit. As new devices are introduced, lots of alarms, alerts and false alarms, and alarm fatigues are making threats to patients’ safety. In addition to the all the alerts and alarms in PICU, ambient noise (e.g., ventilation and air conditioning systems and incidental noise (e.g., telephone ringtone, hospital announcement and music sound for patients) cause more stress and further limit alarm detection.

2. Method

We made alarm management committee and established a standardized alarm range. Medical staff training about alarm management, 4 Safe PICU slogan (Silent Environment, Set the Alarm Range, Speedy Response, Solve the Problem) and 4 safe alarm setting checklist was made to reduce false positive alarm and to set the individualized correct alarm setting. To reduce medical device noise, ambient noise and incidental noise, we checked all device and environment noise level, repair equipment, change lower noise machine, lower the call bell and door bell tone, attached noise prevention guard and so on.

We also created patient safety culture to manage patient alarm and check patient condition properly.

3. Result

The standardized alarm parameter management of PICU, staff training, patient alarm reduction and management campaign, and noise reduction activities reduced medical device’s noise level and ambient noise. Also we established patient alarm management culture and all the medical staff gained a better understanding of the necessity of Alarm management and a deeper appreciation for alarm management by multiple clinical practices.

5. Conclusion

Additional study will be needed based on current needs, nurse perception, and evidence-based practice. We propose other ICU will join to develop and implement their own alarm management guideline for patient safety.
Development of Infrastructure for CRRT Machines: Shortens Time Lag for Initiation, Improving Quality of CRRT Care

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1. The Need for Activity

The use of Continuous Renal Replacement Therapies (CRRT) has become common practice in Intensive Care Unit (ICU) settings for treatment of acute kidney injury. In Seoul National University Bundang Hospital, eight CRRT machines in the 5 adult ICUs are independently operated. As the machines are limited and used by all departments in the hospital, it is necessary to call another 4 ICUs to ask about the availability of the CRRT machine before starting CRRT. If all machines are being used when a new patient needs CRRT, nephrologist or intensivist should decide which patient to stop or maintain CRRT on the basis of clinical acuity. Thus a significant amount of time is required to initiate CRRT after the decision to start CRRT was made. The time lag between decision and its actual initiation of CRRT remains a major barrier in a hospital with multiple ICUs. To solve this delayed treatment, we developed the "CRRT application/inquiry" screenshot in the electronic medical record which share the present usage in CRRT and the clinical status of CRRT applied patients between medical staffs working in ICUs.

2. Problem Analysis and Goals

1) Problem analysis

Our innovation team called “CRRT screen changing team” was composed of a professor in charge of nephrology and a nurse in charge of ICU. We found problems in CRRT machine application and management through case study and brainstorming. In terms of application, doctors from different department prescribe CRRT with different orders even in the similar patients. In addition, nurses spent a significant amount of time to ascertain the available CRRT machines in the other ICUs.

2) Core indicators and targets

The core indicators of this project were the CRRT preparation time and the request rate to nephrology department. Average time from decision to initiate CRRT and preparation of machine next to the patient supposed to start CRRT was 21.18 minutes before the project (2016.5.1 ~ 31). The goal was to reduce the time for CRRT preparation to more than 25% (less than 15.88 minutes).

3. Improvement activities

Major improvement activities include the construction of CRRT computer program, improvement of CRRT management process, and the training of changed process and its announcement

1) Construction of CRRT computer program

The "CRRT application and inquiry" EMR screenshot program development enables you to view records such as vital signs, test results, injected amount of drug, CRRT setting, etc. of the currently used subject and the termination subject.

2) Improved CRRT management process

CRRT machine management: CRRT machine Allocate machine number for sharing and smooth communication on computer management screen and relocate machine archive to department with frequent machine use

CRRT Order Management: CRRT set Establish order and monthly set-share in training time of major and produce and distribute work manual of major

CRRT Description Enhancement: Electronic Consent Correction, Reference material during acquisition of consent

CRRT Patient Management: Intensification of CRRT related
medical records and activation of other outreach programs

3) Changed process training and announcements

4. Effect of improvement activities

After establishing the CRRT medical infrastructure, the completion rate of CRRT proper preparation rose from 54.54% to 95.5% and the other department referral rate increased from 59.1% to 83.3% from September to November in 2016.

5. Conclusion and future management plan

By establishing a standardized medical treatment process and developing a computerized program, it is expected to prevent delays in medical treatment of patients and to maximize the efficiency of the operation. By establishing the CRRT management screen, the time required for equipment inquiry and preparation time is reduced and the efficiency of nurse’s work is increased. It is anticipated that nursing performance related with CRRT will be smooth by restructuring CRRT infrastructure. We will continue to educate residents and nurses for ongoing monitoring and CRRT screen activation.

REFERENCES

Experience of QI in Stroke Thrombosis

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Sang Beom Jeon

In-hospital delay in thrombolysis may result in morbidity and mortality in patients experiencing acute stroke. We aimed to decrease the in-hospital delay for both intravenous thrombolysis (IVT) and intra-arterial thrombectomy (IAT) through a multi-disciplinary QI approach. We implemented the Stroke Alert Team (SAT), which introduced hospital-initiated ambulance pre-notification and reorganized in-hospital processes. We measured the door-to-thrombolysis time, thrombolysis rate, and post-thrombolysis intracranial hemorrhage. Since implementation of SAT, the median door-to-IVT time decreased from 46 min to 20.5 min. The median door-to-IAT time also decreased from 156 min to 86.5 min. The thrombolysis rate increased from 9.8% to 15.8%, and the post-thrombolysis radiological intracranial hemorrhage rate decreased from 12.6% to 2.1%. Time benefits of SAT were observed for both IVT and IAT and during office hours and after-hours.
Background: Early rehabilitation in intensive care unit refers to rehabilitation within 24 to 48 hours of entry into the ICU as soon as respiratory and hemodynamic stability are achieved. Although the ICU rehabilitation program is being implemented since 2013, the number of early rehabilitation programs has been gradually decreased and from the initial phase of breathing exercise to education is not consistent due to the newly increased and transferred staff. The purpose of this study is to introduce the results of applying the activities for setting up early rehabilitation program in ICU after surgery.

Method: We assessed the awareness and knowledge levels of early rehabilitation for 25 nurses working in the intensive care unit of Cancer Center at Samsung Medical Center in March, 2017. Based on the results, standardized education was conducted by depending on needs, the awareness, and knowledge levels which were re-evaluated in August by applying activities for setting up early rehabilitation program.

Result: Awareness level increased by 3% and knowledge level increased by 20%. The number of early rehabilitation cases increased after the activities and the number of early rehabilitation increased by 38% compared to the previous year, although there were changes every month depending on the patients’ severity and the characteristics of the patients. Safety-accident rate was zero during early rehabilitation.

Conclusion: Nurses’ awareness of respiration and early rehabilitation in ICU after surgery and the needs of education were also high. It seems that 1:1 simulation training for safe early rehabilitation was helpful in practice. The awareness and knowledge of the medical staff influence the performance rate, and it is considered that the changes of the staff are inevitable and continuous education and evaluation is necessary.
What is ‘Toxic Syndrome (Toxidrome)’?

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Hyunggoo Kang

Toxidromes are the constellation of signs and symptoms associated with a class of poisons. It serves to clue the clinician into the correct diagnosis. Common toxidromes include: anticholinergic toxidrome, cholinergic toxidrome, opioid toxidrome, sympathomimetic toxidrome. Rapid recognition of a toxidrome, if present, can help determine whether a poison is involved in a patient’s condition and can help determine the class of toxin intoxicated.

Select toxidromes that may be diagnosed via the physical examination may be found in Table 1. Additionally, although toxidromes may be applied to classes of drugs, some individual agents within these classes may have one or more toxidrome findings absent. Many toxidromes have several overlapping features. For example, anticholinergic findings are highly similar to sympathomimetic findings, with an exception being the effects on sweat glands: anticholinergic agents produce warm, flushed dry skin, whereas sympathomimetic agents produce diaphoresis. Toxidrome findings may also be affected by individual variability, comorbid conditions, and co-ingestants. For example, tachycardia associated with sympathomimetic or anticholinergic toxidromes may be absent in a patient who is concurrently taking beta-adrenergic receptor antagonist medications. Patients may not present with every component of a toxidrome and toxidromes can be clouded in ingestions of multiple drugs.

Table 1. Physical findings of representative toxidromes

<table>
<thead>
<tr>
<th>Toxidrome</th>
<th>Sign and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergic</td>
<td>Skin flush, mydriasis, tachycardia, anhidrosis, dry mucous membranes, hypoactive bowel sounds, altered mental status, delirium, confusion, urinary retention, constipation</td>
</tr>
<tr>
<td>Cholinergic</td>
<td>Diarrhea, diaphoresis, involuntary urination, miosis, bradycardia, bronchorrhea, emesis, lacrimation, salivation</td>
</tr>
<tr>
<td>Opioid</td>
<td>Coma, sedation, miosis, decreased bowel sounds, decreased respiratory efforts, bradycardia</td>
</tr>
<tr>
<td>Sympathomimetic</td>
<td>Agitation, mydriasis, tachycardia, hypertension, hyperthermia, diaphoresis</td>
</tr>
</tbody>
</table>
An antidote is a substance which can counteract a form of poisoning.[1] The term ultimately derives from the Greek (pharmakon) antidoton, "(medicine) given as a remedy". Antidotes for anticoagulants are often referred to as reversal agents.[citation needed]

The antidotes for some particular toxins are manufactured by injecting the toxin into an animal in small doses and extracting the resulting antibodies from the host animals' blood. This results in an antivenom that can be used to counteract poison produced by certain species of snakes, spiders, and other venomous animals. A number of venoms lack a viable antivenom, and a bite or sting from an animal producing such a toxin often results in death.[citation needed] Some animal venoms, especially those produced by arthropods (e.g., certain spiders, scorpions, bees, etc.) are only potentially lethal when they provoke allergic reactions and induce anaphylactic shock; as such, there is no "antidote" for these venoms because it is not a form of poisoning and anaphylactic shock can be treated (e.g., by the use of epinephrine).

Some other toxins have no known antidote. For example, the poison aconitine – a highly poisonous alkaloid derived from various aconite species – has no antidote, and as a result is often fatal if it enters the human body in sufficient quantities. Ingested poisons are frequently treated by the oral administration of activated charcoal, which adsorbs the poison and flushes it from the digestive tract, thereby removing a large part of the toxin. Poisons which are injected into the body (such as those from bites or stings from venomous animals) are usually treated by the use of a constriction band which limits the flow of lymph and/or blood to the area, thus slowing circulation of the poison around the body. This should not be confused with use of a tourniquet which cuts off blood flow completely - often leading to the loss of the limb.

References

2. Rommel KP, Schneider E, Witschel I, Halm U, Zachäus M. Three cases of severe chronic diarrhea with a rare cause and a simple therapy 2018 Apr 10. [Epub ahead of print]
Extracorporeal Elimination in Acute Poisoning

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Poisoning incidents are considered a major public health issue worldwide. Acute poisoning (accidental or intentional) requires accurate assessment and prompt therapy. Early identification of the toxins is crucial and the majority will be identified by a thorough history and physical examination. An ABC-approach should be followed ensuring a protected airway, adequate ventilation and hemodynamic stability. Supportive and symptomatic care remains the cornerstone of treatment. Also the administration of antidotes and enhancement of elimination of the poison are very important. Enhanced elimination techniques can accelerate removal of a toxin. The main methods of enhancing the elimination of toxins are hemodialysis and hemoperfusion. Hemodialysis (HD) is through a semipermeable membrane down a concentration gradient into a dialysate. The water soluble toxin, e.g. toxic alcohols, could be removable. Also Electrolyte disturbances and metabolic acidosis in acute poisoning patients also can be readily corrected with this intervention.

Hemoperfusion refers to the circulation of blood through an extracorporeal circuit containing an adsorbent such as activated charcoal or polystyrene resin. In contrast to HD circuits, hemoperfusion devices provide a large surface area to directly bind toxins. The advantage of hemoperfusion is that it can remove protein bounded or lipid soluble toxins. But hemoperfusion could not correct the electrolyte disturbance and metabolic acidosis. Continuous renal replacement therapy (CRRT) has gained acceptance as an effective alternative treatment. In general, CRRT has lower clearance rates than conventional HD. It might offer some benefit in unstable or hypotensive patients. Peritoneal dialysis is much less effective than HD or hemoperfusion. Peritoneal dialysis is not recommended in poisoned patients.

Although supportive care is the mainstay in the management of poisoned patients, extracorporeal treatments play a crucial. The understanding of each extracorporeal therapies, their technical particularities, advantages, and limitations is needed to make a rational use of available modalities.
Acute Care Surgery (ACS) is an evolving specialty with three essential components—Critical care, trauma and emergency surgery. In 2002, AMC (Asan Medical Center) innovated a new platform for critical care and perioperative care led by surgical intensivist first in Korea. Later trauma (2007) and emergency surgical care (2017) was followed after critical care. It was clear that acute care surgeons are increasingly responsible for trauma and critical care surgeons. Division of Acute Care Surgery excel at managing the most critically injured and ill patients, providing them high quality care 24 hours day—seven days a week. The acute care surgery team uses evidence-based medicine and surgical techniques to provide the best optimal care to the critically ill patient. Acute care surgeon Still, rigorous trial to ensure each trainee meets the goals of the Acute Care Surgery is necessary.
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Jung-Min Bae

Generally, acute care surgery (ACS) includes emergency general surgery, surgical critical care and the surgical management of trauma patients. In USA, many hospitals have ACS department and ACS fellowship. However, in Korea, ACS department or ACS faculty are in some centers. In most of all hospitals, ACS is performed in turn between several surgeons.

ACS have several unique characteristics. Physician in ACS is need to knowledge base of surgical disease, surgical pathophysiology, operative manner, knowledge of peri-operative complication, skillful surgical procedure, knowledge of acute surgical disease, judgment in unusual case, leadership of trauma team, resuscitation skill, knowledge of various organ trauma and ability of performing damage control surgery.

Furthermore, physician in ACS suffered from emotional and physical stress because of work loading, legal issue etc.

In surgical critical care, ACS members are surgical critical care specialist that they have the unique ability to know the surgical disease, operative procedure and surgical pathophysiology.

In emergency surgery, skillful surgeon have good prognosis. ACS surgeon is apt to emergency surgery.

In multiple or severe trauma, ACS surgeon is inevitable that surgeon should coordinate and collaborate between diverse injured organ, diverse treatment, triage of treatment and resuscitation.

Furthermore, ACS have additional role that control and treat of post-operative complication after elective surgery in hospital or other hospital because in small volume hospital, ACS specialty is absent.

In skillful surgical procedure, ACS physician is trained and need to abundant surgical procedure experiences

Eventually, the future direction of ACS is defined as trauma, emergency surgery, surgical critical care, elective surgery and surgical rescue.

In ACS, specialty and system of Korea ACS is beginning state. Now, we introduce our hospital system.

REFERENCES

The specialties who can deal with emergency medicine and emergency surgery are increasingly in need; however, to date, this type of surgical specialty seems not to be established in Korea, while a trauma surgery has become a recognizable specialty and the care of the trauma patient is constantly improving. Recently, fewer surgeons are being general. Rather, surgeons became more “organ-specific” with no or little competence in trauma surgery, emergent surgical care, and surgical critical care. The focus of general surgery has shifted from broad spectrum of diseases and surgical techniques to narrow point of treatment. Highly focused specialization in all aspects of medicine is necessarily required as the complexities of disease increase. In contrast, the sheer depth and breadth of cognitive and technical knowledge in any one field of medicine may preclude total expertise in any broadly based specialty. Additionally, evidence of better outcomes with the concentration of complex problems and procedures at “centers of excellence” and remuneration strategies that favor specialized procedure care, may lead to further fragmentation and super-specialization. Moreover, with the dramatic decrease in operative volume for trauma (good for patients; bad for surgeons), the trauma surgeon of the past has become extinct. Trauma care is thus in need for resuscitation and revitalization. Trauma and critical care surgeons in the USA have reexamined their role based on these concerns and the realization that surgeon resources for the injured patient are in jeopardy. The new emphasis on non-trauma emergency surgery required an image change and thus a new name introduced as “Acute Care Surgery”. After much work over the past several years, a model of “Acute Care Surgery” has emerged and a training curriculum has been proposed.

In this presentation, we aimed to introduce our individual experiences and perspective to help promote development in the field of acute care surgery (surgical critical care, emergency surgery, and trauma surgery) in Korea.

REFERENCES

Case Definitions and Validation of Korean National Healthcare-Associated Infections Surveillance System (KONIS) in ICU

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The nationwide surveillance system has previously proven to be effective in managing healthcare associated infections (HAI), and thus, several countries are operating such systems [1,2]. The Korean National Healthcare-associated Infections Surveillance System (KONIS) was established in 2006 by the Korea Center for Disease Control and Prevention (KCDC) and the Korean Society for Healthcare-associated Infection Control and prevention, with the aim of conducting nationwide surveillance of HAI according to the same standards and methods, as well as develop a network to identify national HAI rates [3]. KONIS is a voluntary and confidential national network, and the intensive care unit (ICU) module has provided an opportunity to understand HAI rates and the actual conditions in each ICU, and thus to aid infection control in Korea. KONIS has collected prospective surveillance data on the incidence and causative pathogens of urinary tract infections (UTIs), bloodstream infections (BSIs) and pneumonia (PNEU), including catheter-associated UTIs, central-line associated BSIs and ventilator-associated PNEU in adult ICUs using standardized protocols. The standardized definition of an HAI is based on those established by the Centers for Disease Control and Prevention (CDC) and used by the US National Healthcare Safety Network (NHSN) system [4,5].

Accurate, high-quality, nationwide surveillance data are important for infection prevention programs for setting priorities and measuring the impact of prevention efforts. Although surveillance definitions are standardized, their application remains variable and resource intensive. KONIS recognizes that the accuracy of the data is important, in addition to the effective operation of the surveillance system, and has conducted a validation study to ensure its scientific credibility and to help identify methodological problems within the surveillance program every two or three years since 2008 [6]. According to the validation study results, the KONIS data were generally reliable and the accuracy was comparable to that of foreign surveillance data. Ongoing validation and continuous training of surveillance personnel will allow more reliable comparisons of infection rates, and will provide consistent data to measure the success of prevention activities, ultimately reducing the HAI rate.

References

Health care-associated infection (HCAI) is a major threat for patient safety and can result in prolonged hospital stays, long-term disability, additional health costs, and increased mortality.\(^1\) To reduce HCAI, surveillance is an essential tool as it is the important first step in identifying problems and priorities in assuring patient safety. It has been shown that conducting continuous prospective nationwide surveillance helped to decrease infection rates in western countries.\(^2\)\(^4\)

The Korean Nosocomial Infections Surveillance System (KONIS) was established in 2006 by the Korea Center for Disease Control and Prevention (KCDC) and the Korean Society for Nosocomial Infection Control (KOSNIC) with an aim to improve infection control practices in intensive care units (ICUs) of hospitals.\(^5\) Participation of hospitals in the system is encouraged and is voluntary. The KONIS system is a nationwide network for prospective surveillance of nosocomial infections including device-associated infections (DAIs) such as catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), and ventilator-associated pneumonia (VAP) in adult patients in ICUs of participating hospitals.\(^5\)\(^6\)

Several studies have shown that the HCAI rates decrease after continuous prospective surveillance.\(^5\)\(^6\) In the KONIS system, we observed a reduction in DAI rates in ICUs participating in KONIS.\(^5\) The reason for the observed decrease in DAI rates could be the voluntary efforts by the participating ICUs to improve infection control practices and adherence to DAI guidelines for patient safety. In addition, several national policies may have contributed to the decrease of DAI rates during the study period.

The proportion of Gram-negative bacteria as nosocomial pathogens for CLABSI and VAP has increased in KONIS system.\(^5\) The prevalence of A. baumannii causing DAIs in Korean ICUs has increased rapidly, as has the rate of carbapenem resistance in these bacteria.

KONIS data are generally reliable, and we are performing regular validation and continuous training of surveillance personnel to maintain the accuracy of surveillance data.

This presentation will show 10 years' achievement and prospect of Korean national healthcare-associated infections surveillance system in ICU.

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Useful Intervention to Reduce Burden of Healthcare–Associated Infections in ICU

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So–Yeon Yoo

The Centers for Disease Control and Prevention (CDC) estimates that 1 of every 10 to 20 patients hospitalized in the United States develops a healthcare-associated infection (HAI). Healthcare institutions have focused infection prevention efforts on monitoring patient clinical outcomes and finding ways to prevent HAs. Recently, healthcare organizations, professional associations, government and accrediting agencies, legislators, regulators, and consumer advocacy groups made HAs a national priority[1]. Therefore, it is crucial for the health care workers to adhere to evidence-based practice recommendations to prevent HAI.

Hospitals routinely focus their work on central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia (VAP), catheter-associated urinary tract infections (CAUTIs), and surgical site infections (SSIs). In addition, multidrug-resistant organisms infection and emerging infectious diseases command prevention efforts because of the increasing incidence, morbidity, and legal actions associated with acquisition of these organisms in the acute care setting and in the community at large.

Of all licensed hospital beds in Korea, only about 5 to 10 percent are intensive care unit beds. However, the prevalence of healthcare-associated infections has been reported to be much greater in critically ill patients than in the general hospital population. Hospitals, especially intensive care units, now deal with a cohort of patients who are most vulnerable to infection as a result of several factors, including advanced age, aggressive medical interventions, immunocompromised states, transplantation, and implanted foreign bodies. Risk factors for infection in the intensive care unit patient include impaired host defenses, extremes of age, and impaired nutritional status. Surveillance for healthcare-associated infections is an important element of an infection prevention and control program in the intensive care unit as an indicator of success.

One of the primary purposes of conducting surveillance is to provide information about performance improvement activities[2, 3]. Many published reports demonstrate the use of surveillance data leads to identify potential problems and risk factors for infection, to implement prevention and control measures, and to reduce infection rates in a variety of healthcare settings[4–9]. An effective infection prevention and control program is the result of an surveillance program that enhances a healthcare institution’s performance improvement activities and reduces the risk of adverse outcomes[10].

An individual or organization can use many approaches and strategies to demonstrate quality improvement. The infection preventionist will plan, implement, and evaluate strategies that ensure compliance with evidence-based practices and accreditation standards, and improve patient safety. The infection preventionists must communicate evidence-based guidelines to leaders and healthcare’s staff within a healthcare organization and integrate the guidelines into a comprehensive program. A multidisciplinary approach and strategy help the infection preventionist develop an organizationwide program that reduces the risk of infection to patients, and health-care workers.

REFERENCES


ECMO for Neonate and Pediatric Patients

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Jae Gun Kwak

The history and evolution of pediatric mechanical circulatory support (MCS) is closely associated with the history of cardiopulmonary bypass. In 1960s, extracorporeal devices could be used to support patients for several days outside the operating room, and Hill et al. reported the first adult extracorporeal membrane oxygenator (ECMO) survivor in 1972. Bartlett et al. reported the first neonatal ECMO survivor in 1976. Then, there are a proliferation of the use of ECMO for various conditions associated with refractory cardiac or respiratory failures. Until now, the largest and most successful single group of patients supported on ECMO are neonates with acute hypoxic respiratory failure with an overall survival to discharge rate of 80%, however, the cases for neonatal respiratory problems which require an ECMO support has been decreased after introduction and development of NO gas, surfactant, and a high frequency ventilator. Congenital diaphragmatic hernia is still one of important indications for neonatal respiratory support. Nowadays, the indication for ECMO support is being widely extended for the young patients with intractable cardiac failure. The indications and situations which require MCS in pediatric patients are not so different from in adult population; however, we should consider several particular things when applying MCS in these young patients group. First, accessible vessels are very limited. Not only because of vessel size in young patients, possible congenitally anomalous intra-cardiac or vascular structures, and prior cardiac operation history also can be important factors to interrupt a usual vascular approach in these groups. Second, immature or underdeveloped organs and hormonal system, hemostatic pathways make it very difficult to control coagulation status or vital signs during the mechanical support. Third, we cannot apply a usual type of a MCS system in the patients with a palliative status, for example, a patient with a ventricular septal defect and pulmonary atresia with a Blalock-Taussig shunt, or a patient with a hypo-plastic left heart with a right ventricle to pulmonary artery conduit.

Although it is not easy to apply four cannulae in these small patients, sometimes we apply a centrifugal bi-Ventricular Assist Device (VAD) system for selected patients without respiratory problems or with a minimal respiratory problem when prolonged mechanical support can be predicted, expecting a lower anticoagulation level, less inflammation, and a better ventricular decompression.

In Korea, an implantable VAD system with small size devices for small pediatric patients has just introduced. However, because of a financial problem, many patients who require a prolonged VAD support cannot be received benefits of this implantable VAD system. We hope that national insurance system can support these patients financially as soon as possible.
Current Status of Neonatal and Pediatric ECMO

Chonnam National University, Korea

Hwa Jin Cho

Extracorporeal Life Support Organization (ELSO)에서 매년 2회 간행하는 international summary에 의하면, 영아 및 소아의 ECMO는 초기에 ECMO 발전에 많은 기여를 하였음에도 불구하고, 전세계적으로 건수는 점차 감소 추세에 있고, 그에 반해 성인 ECMO 건수는 해가 갈수록 증가하고 있는 추세를 보이고 있다.

하지만 세계적으로도 영아 및 소아의 ECMO가 감소 추세에 있음에도 불구하고 약물 반응을 하지 않는 불응성 심폐부전 및 속 (refractory cardiac/respiratory failure and shock) 환자에서는 ECMO는 중요한 치료방법이 되고 있다. 소아에서의 ECMO 적응증은 환자의 다양성으로 한가지로 정의하기는 어렵지만 가역성이 있으면서 일반치료에 반응하는 상태의 환자가 대상이 된다.

우리나라에서 소아 ECMO의 발전이 성인에 비해 뒤늦어진 이유는 기구의 문제와 관심의 문제를 드 될 수 있을 것 같다.

우리나라에서는 아직까지도 소아용 ECMO 전용 키트라는 수입되지 않고, 심장수술용 키트를 이용하고 있다. 심장 수술용 키트는 이론적으로 서서 내지 몇 주간 사용하기 위해 개발된 키트가 아님으로 이러한 키트의 사용은 윤리적으로도 임상적으로도 문제를 야기할 수 있다. 또한 소아용 ECMO 전용 산화기를 이용해도, 적응증의 경우 비교적 최근까지도 성인용 산화기를 이용해온 설정이다. 또한 최근에 수입된 소아용 산화기는 성인용 산화기가 내구성 (durability)을 보장하는 것에 비해 내구성이 짧은 단점이 있다.

소아 ECMO의 발전이 늦어졌던 큰 원인 중 하나는 아직도 소아청소년과 의사들의 관심 부재로 드는다. 하지만 최근 소아 청소년과 의사들의 관심이 과거에 비해 향상되고 있어 영아 및 소아에서 앞으로도 더 많은 발전을 기대해 본다.

REFERENCES

Extracorporeal Life Support during Hemodynamic Unstable VT Ablation

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Jae Seung Jung

ECMO Indication during VT Ablation

1. Bailout indications
   - Intraprocedural hemodynamic deterioration
     → Cardiogenic shock
2. Preemptive indication
   - Preprocedural incessant VT/ES leading to cardiogenic shock, stabilized within the ICU before the ablation procedure
   - High-risk preoperative assessment and nontolerated VTs
   - Previous ineffective substrate modification procedure performed during SR in patients with nontolerated VTs requiring a second ablation based on activation mapping and entrainment

ECMO Management

1. Flow target
   - Cardiac Index 2.0~2.4 L/min/m²
2. Monitoring
   - ABP, CVP, urine output, EKG
   - Perfusionist continuously involved
   - Heparin target : ACT >250 sec.
   - Blood gas were assayed at least every 2 hours during procedure
   - Antibiotics prophylaxis
   - After CA, aPTT 45~50 sec.

- Patients needing CA of VT often have severe heart disease and multiple comorbidities
  → increase the risk of periprocedural hemodynamic decompensation, multiorgan failure and mortality Substrate ablation performed in sinus rhythm is not always feasible, and when mapping during unstable VTs is required, mechanical circulatory support can be considered, but the best strategy is not clear.
- Impella™ can be used for unstable VT ablation, however Cannot reach full cardiac output and additional payment needed, about $25,000

- Extended intra- and periprocedural ECMO support allows lengthy and complex ablation procedures with mapping
- Randomized trial and more evidences are needed for using ECLS during unstable VT catheter ablation

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High Risk PCI

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Introduction

Cardiogenic shock usually occurs as a fatal complication of acute myocardial infarction, cardiomyopathy, and myocarditis, and rarely develops after sepsis. In particular, ST-segment elevation myocardial infarction is complicated with cardiogenic shock ranging from 5 to 8%, and is reported to have very high mortality rate still approaching 40% despite advances in various therapeutic techniques such as percutaneous coronary intervention, coronary artery bypass graft. Cardiogenic shock is characterized by high rate of early mortality, but once the shock is recovered, it has a better prognosis than other shocks. It is difficult to know that the incidence, treatment status and mortality of cardiogenic shock due to other causes than myocardial infarction accurately because most of the studies on cardiogenic shock currently published in Korea were conducted on the randomly selected patients based on Killip class IV in acute myocardial infarction registry. Whether adequate early treatment within 24 hours after the onset of cardiogenic shock has been established determines the prognosis, and in the case of refractory to the standard treatment consisting of fluid therapy, mechanical ventilation and administration of inotropes, mechanical circulation support such as intra-aortic balloon pump (IABP) and extracorporeal membrane oxygenation (ECMO) of peripheral ventricular assist device (VAD) may be used. However, there has not yet been a systematic large-scale domestic study that has confirmed the effects of these treatments. Recently, Thiele et al. failed to demonstrate the superiority of the IABP group in a randomized study comparing IABP treatment group with standard treatment group in patients with cardiogenic shock complicating acute myocardial infarction who was scheduled for early coronary intervention. Therefore, studies on the efficacy and safety of mechanical circulation support, which can more effectively support the left ventricular function, are being actively initiated around the world. Especially, ECMO, which is a peripheral VAD that can be operated anytime and anywhere, is expected to be effective in emergency situation, and the number of procedures is also rapidly increasing due to the surge of interest in ECMO treatment in Korea.

ECMO in patients treated with high-risk PCI

ECMO is a mechanical circulation support, which extracts venous blood from a patient and injects the appropriately oxygenated blood through the artery of the patient. ECMO was first applied in patients with severe pulmonary edema, and with advances in technique over 40 years, can now be applied more safely than in the past. The applicable fields of ECMO have been expanded to include the resuscitation of cardiac arrest or neonates with cardiopulmonary failure, and it is also used in combination with other treatment methods such as hemofiltration and therapeutic hypothermia. In addition, ECMO has been applied to various clinical situations associated with cardiogenic shock and early rejection after organ transplantation. Based on these strategies and experiences, the applicable fields have been expanded gradually to include the patients with sepsis, malignancy and immunosuppression, for whom ECMO was considered to be contraindication in the past. There are two types of ECMO: veno-arterial type, which support heart and lung simultaneously and veno-venous type, which is mainly used for lung failure. Although veno-arterial ECMO (VA ECMO) is available for bridging treatment of heart transplantation as a short-term VAD, the correct application is to apply VA-ECMO in the refractory cardiogenic shock patients with potentially recoverable cardiac function. Recently, the use of VA-ECMO as a means of rescue therapy in cardiac arrest without response to appropriate cardiopulmonary resuscitation for more than 10 minutes has been increasing. In general, the discharge alive of the patients who underwent VA-ECMO due to cardiac dysfunction is 30 to 50%. VA-ECMO is usually applied when cardiac index is less than...
1.2L/min-1m-2, and systolic blood pressure is difficult to maintain above 90mmHg, associated with systematic symptoms of low tissue perfusion despite appropriate preload, the use of inotropes and IABP. The insertion and maintenance of ECMO itself have intrinsic risks such as limb ischemia, bleeding, infection, thrombocytopenia and thrombosis, and according to a recently reported meta-analysis, 16.9% of limb ischemia, 10.3% of compartment syndrome, 4.7% of lower extremity amputation, 5.9% of stroke, 13.3% of neurologic complication, 55.6% of acute renal failure, 40.8% of major bleeding, and 30.4% of significant infections. Particularly, the application of ECMO is inevitably accompanied by two circulatory systems, which may result in ischemic brain damage and pulmonary failure due to left ventricular distension, which are fatal complications. As described above, since there are intrinsic complications, and it has not been clearly proven whether treatment with ECMO is more beneficial than with standard treatment, ECMO should be applied more carefully.

The most interesting area for cardiovascular interventionists is probably ECMO application in cardiogenic shock that occurred during coronary intervention. In a related study conducted by Kagawa et al., ECMO was performed in 86 patients with cardiac arrest during coronary intervention who was unresponsive to conventional cardiopulmonary resuscitation, and the rates of return of spontaneous heartbeat, and 30-day survival were 88%, and 29%, respectively. In acute myocardial infarction that is complicated by cardiogenic shock, proper and rapid application of ECMO is very important. Previous studies, in spite of a small number of study patients, have shown that ECMO-assisted early revascularization for patients with acute myocardial infarction has an impact on survival benefit, and survival rate is higher than in ECMO-assisted group compared to IABP-assisted group. The prognostic factors related to in-hospital mortality in the patients undergoing VA-ECMO due to acute myocardial infarction are old age, cardiopulmonary resuscitation, low lactate clearance and incomplete revascularization. Additionally, the simultaneous use of IABP in the patient undergoing VA-ECMO did not help to improve mortality. Recently, a meta-analysis of the application of VA-ECMO for fulminant myocarditis patients was published, with a high survival discharge rate of 66.9% among a total of 170 patients, indicating that fulminant myocarditis is an appropriate indication for VA-ECMO. When we look at the usefulness of VA-ECMO application in cardiac arrest, which is increasing rapidly in recent years, in 2008, Chen et al. reported a 49% reduction in hospital mortality compared to conventional cardiopulmonary resuscitation, and the study we performed also showed a 47% reduction in hospital mortality. Therefore, if the appropriate candidates of VA-ECMO can be selected in the cardiac arrest patients, it may be the most useful clinical situation in applying VA-ECMO. Recently, another issue in applying VA-ECMO is its application in septic shock. Conventionally, application of VA-ECMO in children with septic shock has been known to be an appropriate indication, but application in adults has been known as a contraindication. In contrast, in a recent study published by Bréchot et al., 10 of 14 patients with septic shock (71%) were successfully discharged. Differences of this study from other studies in the application of VA-ECMO for septic shock are that most of the patients included in this study were accompanied with both sepsis and severe cardiac dysfunction. Actually, cardiac dysfunction is reported to be about 40% in the patients with sepsis, and these patients should be classified as cardiogenic shock with sepsis. In other word, an increase in cardiac output through VA-ECMO can give patients time to recover from sepsis by preventing systemic hypoperfusion, and this suggests that VA-ECMO may be useful for patient survival.

Conclusion

ECMO has been applied to various cardiogenic shocks such as acute myocardial infarction and fulminant myocarditis, and has been expanding its area to early rejection after organ transplantation, and septic shock with myocardial injury in recent years. Considering the serious complications induced by the insertion of ECMO itself, it is important to select candidates who have clinically beneficial effect of ECMO and apply ECMO to them appropriately rather than indiscriminate application.
Airway Surgery

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Do Hyung Kim
Early Management of Patients with Acute Ischemic Stroke: Endovascular Tx

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Hyon–Jo Kwon

Although the intravenous thrombolysis r-tPA (recombinant tissue plasminogen activator) is an effective and relatively fast treatment modality for acute ischemic stroke patients, the remaining problem is that the rates of vascular recanalization especially in the occlusion of large artery occlusion remain poor [1]. On the other hand, earlier endovascular treatments using r-tPA or urokinase plus microwire and microcatheter have shown superior recanalization rates [2]. During intra-arterial thrombolytic therapy we can infuse concentrated thrombolytics in the thrombus directly while reducing the total doses of thrombolytic agents to achieve final recanalization. The disadvantages of initial intra-arterial approaches include the relative time delay to the commencement of therapy, need for a dedicated and specialized intervention team and angiomachine, and the risk of vessel injury and hemorrhage during micro-wire and catheter manipulation [3]. Overall recanalization rate after intra-thrombolysis was 47-80% and good neurological outcome at 90 days (mRS 0-2) was noted in 40-57%. Moreover, no greater symptomatic intracerebral hemorrhagic transformation was associated, with rates of 9-15.4% for various agents [4].

Recently the intra-arterial thrombolysis have been modified as mechanical thrombectomy using stent retriever or suction catheter. Early generation retriever such as MERCI was approved by the FDA in 2004 and other various retrievers with stent-like features such as CATCH, Solitaire FR, TREVO, REVIVE, ERIC have been developed to restore blood flow. The devices restore the blood flow temporarily by exerting radial force on the thrombus during temporary deployment and drag the thrombus out of cerebral vessel during retrieval of the devices [5,6]. Earlier device using suction force was penumbra system which is composed of 3 components: a reperfusion catheter, separator, and thrombus removal ring. With the advancement of device engineering, the largest bore of catheters which can be delivered distal intra-cranial vessel has increased greatly and Penumbra suction catheter without separator developed [7]. Nowadays, we can extract the thrombus occluding cerebral vessel directly with only suction catheter and syringe or pump.

Recent 5 randomized controlled studies published have revealed the superiority of these treatment modalities and further studies are following to extend the time window of mechanical thrombectomy [8-14]. The two main streams as stent-retriever and suction catheters are competing for better initial and long-term outcome now.

Overall recanalization rate after mechanical thrombectomy was 24-100% and good neurological outcome at 90 days (mRS 0-2) was noted in 22-60%. Symptomatic intracerebral hemorrhagic transformation rates were 6-20% for various devices [4].

We believe the outcomes will be improved more and more with better devices and selection of patient using more refined imaging modalities.

REFERENCES


Early Management of Patients with Acute Ischemic Stroke: Surgical Treatment

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Decompressive craniectomy is a well-known surgical management for ischemic stroke. The increased intracranial pressure that does not respond to medical therapy can be effectively reduced by removing the skull broadly. There were 3 multicenter randomized control trials for comparing the effect between medical and surgical therapy for malignant middle cerebral artery infarction in Europe. Decompressive Craniectomy in Malignant Middle Cerebral Artery Infarction (DECIMAL), Decompressive Surgery for the Treatment of Malignant Infarction of the Middle Cerebral Artery (DESTINY) and Hemicraniectomy After Middle Cerebral Artery Infarction With Life-threatening Edema (HAMLET) provided that decompressive craniectomy are superior than medical therapy only. On those studies, mortality of medical therapy only group reached up to 71% but surgical mortality was 24% which had a statistical significance. Based on these report, American Heart Association (AHA) recommended that: In patients <60 years of age with unilateral MCA infarctions that deteriorate neurologically within 48 hours despite medical therapy, decompressive craniectomy with dural expansion is effective. The effect of later decompression is not known, but it should be strongly considered (Class I; Level of Evidence B). DESTINY II was performed on elderly patients over 60 years of age and revealed similar results that surgery could decrease the mortality in elderly patients. But there were little studies for improving functional outcomes. There was no good outcome (modified Rankin Score (mRS) 0 or 1) patients. Most survivors remained severe disabled. In some studies, cranial resection was performed before consciousness deterioration in order to obtain good functional outcome. They showed good functional outcomes but still it is unclear whether this is the effect of surgery or the patient who did not need surgery. With the expansion of mechanical thrombectomy in the future, the number of patients requiring decompression will decrease. In addition, based on perfusion images, patients who are in need of surgery may be preselected to improve the functional outcome.

Surgical thrombectomy is the most effective way to remove blood clots by opening the cerebral vessels after craniotomy. However, compared to endovascular thrombectomy, it takes much preparation time to open the blood vessels and the patients who are using antithrombotic agents have limitations such as hemostatic problems. In addition, because of the time limitation of opening the blood vessels within 6-8 hours, surgical thrombectomy was not actively performed. Since Welch.K et al reported first surgical thrombectomy series in 1956, only about 20 case series have been reported until now. Most of them performed in pre-endovascular thrombectomy era. Recently surgical thrombectomy performed only for the endovascular thrombectomy failure cases. So there was no randomized control trial or large series retrospective study. Overall favorable outcome reaches 50-70% in previous reports. The good indication for surgical thrombectomy is cardioembolic origin red thrombus in distal internal carotid artery or proximal middle cerebral artery. Recent DAWN trial which is randomized control trial for endovascular thrombectomy have successfully extended the time available for thrombectomy up to 24 hours in small infarction volume case. In DEFFUSE III which is another recent endovascular thrombectomy trial, the patient who had a diffusion perfusion mismatching selected as a thrombectomy candidate up to 16 hours after the infarction. So the time window of surgical thrombectomy can be extended according to recent revascularization trial.

Surgical or endovascular thrombectomy always have the risk of reperfusion injury and still time limitation up to 24 hours. Superficial temporal artery to middle cerebral artery (STA-MCA) anastomosis is another surgical option for acute ischemic stroke. This procedure has wide time window so many patients can be included as a candidate. There is little chance of reperfusion injury because the STA has low blood flow and the ischemic penumbra area is mainly supplied with blood flow but the cerebral infarction area is not affected. Augmented blood flow can prevent ischemic penumbra from worsening to cerebral infarction. Good indication for this surgery is a patient who has a large vessel occlusion with small infarction volume and wide ischemic penumbra area. This patient has a high risk of infarction progression due to hypoperfusion.
Intracerebral hemorrhage (ICH) is the second most common subtype of stroke and a leading cause of severe disability or death. Its mortality rate reaches up to 40% at 1 month and achievement of long term functional independence is very low as 12% to 39% of survivors. It costs large socioeconomic expense and the 2010 Global Burden of Disease (GBD) Study showed that the absolute number of hemorrhagic strokes increased 47% worldwide for the last two decades. And many large scale prospective studies were performed in this particular disease entity. However, its clinical outcome is still poor. In this review, updated knowledge about the management of ICH regarding to etiology, medical treatment and advanced surgical treatment.
Prolonged mechanical ventilation (>21 days) is associated with higher ventilator-associated pneumonia and ventilator-associated lung injury, longer intensive care unit and hospital days, increased mortality (1-year mortality of 52%), and higher medical costs. However, 20% to 30% of patients are difficult to wean from invasive mechanical ventilation. Typically, the difficulty in transitioning patients to spontaneous breathing may be categorized as simple transition, difficult transition, and prolonged transition.

There are a lot of predictors for weaning failure such as cardiac dysfunction, increased respiratory rate, diaphragm dysfunction, rapid shallow breathing index, etc. However, weaning failure involves complicated mechanisms that are not solved by one cause. Recently, P. Mayo published a review paper on ultrasonography evaluation during the weaning process. We need to pay attention to this paper. While lots of previous predictors cannot explain the reason, ultrasound evaluation is a process of finding the cause as well as prediction for weaning failure. However, we need a more practical and standarized ultrasound protocols for how to wean invasive mechanical ventilation. “Ultrasonographic mechanical weaning protocol” should not comprise just one indicator, but include various indicators such as upper airway stenosis, heart function, the status of the lung and pleura, diaphragmatic function, etc. (Fig. 2).

This integrated ultrasound protocol will help in successful weaning of invasive mechanical ventilation.

Fig. 1. Weaning process of invasive mechanical ventilation.

Fig. 2. POCUS guided weaning process (ABCDE).

References


About 95% hospitalized patients need IV therapy. Reliable venous access is a cornerstone of safe and effective care of hospitalized patients. Common vascular access procedures include peripheral venous, peripherally inserted central venous catheter (PICC), and central venous cannulation. Although these procedures can have major and minor complications, their success significantly depends on patient anatomy, comorbid conditions and operator skill. Ultrasound guidance for vascular access has been in clinical practice for more than 30 years and has been increasingly utilized for target vessel visualization to minimize complications and increase success rates during vascular cannulation.

US-guided peripheral intravenous (PIV) catheter: The landmark technique for PIV has a success rate of 90% for ED patients. However, that still leaves many patients who require PIV but are difficult to cannulate, often because of obesity, a chronic medical condition, or a history of IV drug abuse. US-guidance facilitates placement of PIV catheters when standard technique fail. Learning US-guided technique is relatively easy, especially for providers who are proficient in the placement of standard PIV catheters.

US-guided central venous catheter (CVC): US guidance is now considered the gold standard technique for CVC insertion via the internal jugular vein (IJV). The subclavian vein (SCV) is a useful alternative to the IJV, however, SCV is not easily amenable to US-guided access because the clavicle obstruct views of the vessels. US-guided axillary vein (AxV) cannulation could be a safe and effective alternative to the IJV.

US-guided PICC: The use of PICCs has many advantages in the intensive care unit (ICU) setting because these devices are associated with low-risk insertion, even in patients with altered coagulation and/or difficult neck anatomy. And PICCs are also usually considered a device at low risk for catheter-related bloodstream infection (CRBSI), which may be an additional advantage in acutely ill patients. However, adverse events incidence remains high and constitutes a significant risk for the intra-hospital transport of critically ill patients, so if possible, bedside procedure should be considered in ICU patients. The method is quite simple, easy to learn and to teach, and safe.

References
Critically ill patients admitted to the intensive care unit (ICU) are frequently at risk for muscle atrophy [1]. Patients with loss of muscle mass have prolonged ICU stays, difficulty in weaning from the ventilator, longer hospitalization, and higher mortality [2]. Muscle mass may also attribute to the physical function post-ICU [3].

Although there are many methods to measure muscle mass such as magnetic resonance imaging, computed tomography, dual energy X-ray absorptiometry, bioelectrical impedance analysis [4], there are many challenges in applying them in the ICU. The use of ultrasound to assess skeletal muscles is still in its early stage. The benefits of using ultrasound is that it can be done at the bedside, can assess specific muscles. Also, it can be checked frequently during the ICU stay to assess the rate and extent of degradation in muscle mass [5].

In many of the studies skeletal muscle was assessed by imaging one or more anatomical sites using ultrasound to obtain the muscle thickness or cross-sectional area (CSA). Patients were assessed in supine position with their knee in passive extension and neutral rotation. Linear array transducer is used with ample amount of gel was used to allow acoustic contact without depressing the skin surface [6-7] or maximally compressed by the ultrasound [8]. Studies have shown decreased thickness or CSA of quadriceps muscle compared to baseline measures [6-7].

However, these methods have not been validated against whole body skeletal muscles mass in ICU patients. A recent study of more than 200 ICU patients showed that ultrasound-based quadriceps muscle layer thickness has only moderate correlation with abdominal muscles CSA (concordance index of 0.67, p < 0.002), but fortunately the measurements are quite reproducible [8]. More studies are needed to find the optimal protocol for musculoskeletal ultrasound measurements in the critically ill patients, to help identify patients at risk of poor ICU and post-ICU outcomes.

References

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ICP Monitoring and Therapeutic Approach

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The mainstay of the invasive neuro-monitoring in critical care is measurement and interpretation of intracranial pressure (ICP) and cerebral perfusion pressure (CPP). ICP is the pressure exerted by the brain, blood, and cerebrospinal fluid (CSF) in the rigid intracranial vault. CPP is a major factor that affects cerebral blood flow (CBF). It is determined by calculating the difference between mean arterial pressure (MAP) and ICP (CPP = MAP - ICP). CPP can therefore decrease as a result of decreased MAP, increased ICP, or a combination of both. CPP is proportional to CBF as long as diameter of cerebrovascular structures and its resistance remain constant. Optimal CPP values have not been clearly established, but 50–60 mmHg is generally accepted as the minimum pressure required to prevent further brain injury. Individualization of optimal MAP and CPP may be available when pressure reactivity index (PRx) is calculated. PRx is a moving correlation coefficient of MAP and ICP. In this presentation, the author will introduce how clinicians can measure and interpret ICP, CPP, and PRx.
Metabolic Monitoring and Therapeutic Approach

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Ji Man Hong

After the primary brain injury, neurologically-critical patients are at risk of developing its downstream secondary brain insult from ischemia, inflammation and edema. The brain requires oxygen and glucose to meet its metabolic demands, and cerebral blood flow (CBF) is its supply channel. Secondary brain injury is a potentially modifiable cause of mortality and morbidity, and the primary aim of neurocritical care against impending brain destruction is to reduce the burden of secondary injury. Tissue hypoxia often is the final common pathway for cellular damage after acute brain injury in association with the aerobic and anaerobic metabolism of glucose. Brain tissue oxygen and cerebral metabolism monitoring provide critical physiological information, monitoring lactate, pyruvate, glucose, other neurotransmitters during the course of acute brain injury can give us additional insight into the pathophysiological processes.
Cerebral Hemodynamic Monitoring for Severe Brain Injury

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Sang-Bae Ko

Secondary brain injury is very common and one of the factors related with neurological outcome in patient with severe acute brain damage. Therefore, neurocritical care mainly focuses on preventing secondary brain injury. Among the various forms of secondary brain injury, the most important and common form is related with hemodynamic deterioration including intracranial pressure crisis and brain oxygen failure. Here, we will discuss the significance of early detection and active management of hemodynamic deterioration in patients in the neurological intensive care units.
Korean ICU Admission, Discharge, and Triage Guidelines 1

Korea University, Korea

Jae Seung Jung
Impact of a sepsis bundle on patients’ outcome: education program to improve sepsis management and outcome

Hallym University Sacred Heart Hospital

Sunghoon Park

Since 2004, the Surviving Sepsis Campaign (SSC) group, in partnership with Institute for Healthcare Improvement (IHI), developed the SSC bundle, with the goal of reducing mortality by 25%. Although the 3-h and 6-h SSC bundles were introduced in the 2012, the 6-h bundle was revised in 2016 due to the negative results of three randomized controlled studies on the Early-Goal Directed Therapy (EGDT).

The implementation of sepsis bundle has been a cornerstone of sepsis performance improvement program, and many observational studies showed that performance improvement programs were associated with a significant increase in compliance with the sepsis bundles and a reduction in mortality. Levy and colleagues reported low mortality rates in high-compliant hospitals during a 7.5-year observation. Recent analysis using sepsis registry (in New York State) also reported that the compliance of 3-h sepsis bundle was associated with lower risk-adjusted in-hospital mortality. Among variables investigated, high-income countries, surgical ICUs, long duration of implementation, and presentation to Emergency Department seemed to be associated with high compliance. However, some authors observed that the rate of compliance continued to increase during the first 2 years of implementation, and there was a mortality reduction even when the bundle completion was delayed.

Importantly, many Asian intensive care units reported a low compliance rate with SSC bundles. In South Korea, the compliance rates was only 5.6%, which was associated with shortage of critical care personnel. These data highlight how important the sufficient critical care personnel (e.g., intensivists and nurses) are for improving performance. Therefore, through further studies, we should find solutions to increase bundle compliance, as well as other barriers.
Revised Korean Glossary of Critical Care Medicine

The Committee for Standardization, Korean Society of Critical Care Medicine

Youjin Chang, Su Jin Kim, So Young Park, Sung Hoon Park, Sarah Soh, Joo Han Song, Jae-Myeong Lee, Ju Yong Lim, In Seok Jung, Chi Ryang Chung, Yang Hyun Cho, Jae-Seung Jung

The first edition of Korean Glossary of Critical Care Medicine was published in 2007 by the Korean Society of Critical Care Medicine (KSCCM). The revised edition of Korean Glossary of Critical Care Medicine has been conducted from the fall of 2016 to the spring of 2018 by the Committee for Standardization of KSCCM. The existing Korean terms of Korean Glossary of Critical Care Medicine were updated based on the 5.1 edition of the English-Korean Medical Terminology published by the Korean Medical Association (KMA). A portion of the existing terms were corrected or deleted in the light of the recent updates of critical care medicine after making an agreement between the members of the committee. To complement the previous edition, new terms were added to it based on the indices of the third edition of Textbook of Critical Care Medicine published in April 2016 by KSCCM and the 7th edition of Textbook of Critical Care published in Jan 2017. During the process, the English terms were translated to the Korean terms found upon the 5.1 edition of the English-Korean Medical Terminology by KMA. Then, terms which were not included in the English-Korean Medical Terminology were translated to the Korean terms by mutual consent between the members of the committee. In addition, since 2007 the newly developed or introduced terms were added to the revised edition through consultations with the members and the directors of the committees of KSCCM. We expect that revised or newly introduced terms in this edition could be used readily and give precise information to all concerned about critical care medicine.
Hall A (HANRA 1+2), 3F
- Oral01–02 (O–001–O–009)

Hall B (HANRA 3), 3F
- Oral03–04 (O–010–O–018)

Hall C (SHILLA 1+2+3), 3F
- Oral05–06 (O–019–O–027)

Hall D (BAEKJE 2+3+4), 4F
- Oral07–08 (O–028–O–037)

Hall E (GOGURYEO 1+2+3), 5F
- Oral09–10 (O–038–O–046)

CR 1 (BAEKJE 1), 4F
- Oral11–12 (O–047–O–056)

CR 3 (BAEKJE 5), 4F
**O-001**

**Time to treatment and Mortality During Protocolized Emergency Care for Sepsis**

**Samhbu Dutta***

EX NAVY  
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**Introduction:** In patients with severe sepsis or septic shock, faster completion of a 3 hour protocolised bundle of care, compared with a slower time, affect in hospital mortality?

**Background:** Sepsis is a life threatening condition with high mortality. Sepsis “bundles” combining high impact interventions have been popularised since the 2000s, with the most notable being the Early Goal Directed Therapy (EGDT) approach which became part of the Surviving Sepsis Campaign (SSC){1}. These bundles usually include early antibiotics, source control, and rapid haemodynamic resuscitation.{2}

**Design**  
Retrospective observational study in our 240 bed secondary care charitable hospital .  
Risk adjustment model for in-hospital mortality designed using confounding variables  
Age  
Co-morbidities  
Site of infection  
Admission source  
Measures of illness severity (shock, lactate, platelet count, mechanical ventilation

**Inclusion:**  
Age >17 years  
Severe sepsis or septic shock as defined by 2001 International Sepsis Definitions Conference (Sepsis-2)

**Exclusion:**  
Completion of 3 hour bundle >12 hours after initiating protocol  
Bundle contraindicated  
Advanced directives limiting treatment  
Patient declined intervention  
Patient already in another clinical trial

**Intervention**  
3 hour bundle:  
Blood cultures before antibiotics  
Measurement of lactate  
Administration of broad spectrum antibiotics  
6 hour bundle:  
30ml/kg fluid bolus in patients with hypotension or a lactate >4meq/l  
Vasopressors for refractory hypotension  
Re-measurement of lactate within 6 hours of starting protocol

**Control**  
Did not have 3 hour bundle completed within the time set

**Outcome**  
Primary outcome: In hospital mortality  
Secondary outcome:  
Giving antibiotics through hours 3-12, compared to administering within hours 03.  
Delaying fluid bolus per hour delay odds ratio  
Delaying blood cultures: odds ratio per hour of delay

**Results:** Of the 80 enrolled patients from April 2105 to March 2016, 39 were assigned to the EGDT group and 41 to the usual-care group. Primary outcome data were available for more than 99% of the patients. Patients in the EGDT group received a larger mean (±SD) volume of intravenous fluids in the first 6 hours after randomization than did those in the usual-care group (2000±1400 ml vs. 1700±1400 ml) and were more likely to receive vasoressor infusions (66% vs. 57%), red-cell transfusions (13% vs. 7%), and dobutamine (15% vs. 2%) (P<0.001 for all comparisons). At 90 days after randomization, 7 deaths had occurred in the EGDT group and 8 had occurred in the usual-care group, for rates of death of 18.4% and 18.7%, respectively (absolute risk difference with EGDT vs. usual care, -0.3 percentage points; 95% confidence interval, -4.1 to 3.6; P=0.90). There was no significant difference in survival time, in-hospital mortality, duration of organ support, or length of hospital stay.

**Conclusions:** More rapid completion of a 3-hour bundle of sepsis care and rapid administration of antibiotics, but not rapid completion of an initial bolus of intravenous fluids, were associated with lower risk-adjusted in-hospital mortality.

**References**


**Key words:** egdt, sepsis, shock

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**O-002**

**Bladder irrigation with 1% povidone–iodine in prevention of Catheter Associated UTI in ICU patients**

**MD. Zafor Iqbal1, M Abdur Rahman2, Lutful Aziz3***

Associate Consultant, SICU & HDU, Apollo Hospitals, Dhaka1, Professor of Anaesthesia, pain and ICU, Bangladesh Medical College, Dhaka2, Sr. Consultant Anaesthesia, Analgesia and ICU,
Objective: To determine the effectiveness of 1% povidone-iodine bladder wash in the prevention of catheter-associated urinary tract infection (CAUTI) in ICU patients.

Methodology: A total of 80 admitted patients who need Foley’s catheter in ICU during this study period at the study place were included in the study according to inclusion and exclusion criteria. Patients were enrolled in Group-A; received 1% povidone-iodine bladder wash, Group-B; received standard catheter care by matching sampling method. Tri-channel Foley’s catheter was introduced with standard aseptic protocol and patient who received Bi-channel Foley’s catheter on same ICU admission day, the catheter was replaced by a Tri-channel Foley’s catheter in ICU setup. For both groups, 1st sample of urine were collected just after insertion of catheter and send it to the microbiology laboratory to see any growth of microorganisms (Culture) and their sensitivity pattern of antibiotics (C/S).

After getting 1st sample report the subsequent urine sample for C/S was collected on day 3rd, 7th, and then weekly till removal of catheter or up to 28th post catheter insertion day, which one come first. CAUTI was diagnosed when the urine culture shows growth of microorganism $\geq 10^5$ CFU/ml of urine.

Result: Growth of microorganism was significantly higher (42.5%) in Group-B in comparison to Group-A (17.5%). Escherichia coli, Klebsiella pneumoniae and Pseudomonas aeruginosa was frequently isolated organism in both groups. Patients without 1% povidone-iodine bladder wash had 2.42 times the risk of CAUTI compared to patients who received 1% povidone-iodine bladder wash with a 95% confidence interval ranging from 1.12 to 5.21.

Conclusion: Iodine has been recognized as an effective broad-spectrum bactericide, and it is also effective against yeasts, molds, fungi, viruses, and protozoans. One percent (1%) povidone-iodine bladder wash is a simple, cost-effective method to reduce CAUTI.

Key words: CAUTI, Povidon-iodine, Bladder wash

O-003

Effect of Aerosolized and Loading Dose of Colistin in Carbapenem Resistant Pneumonia Patients

Chul Park, Jun Su Choe*, Suk Hyeon Jung, Chi Ryang Chung, Gee Young Suh, Hyo Jung Park, You Min Sohn, Jeong Mee Kim, Kyeong Man Jeon

Samsung Medical Center

Background: Colistin has been used to treat hospital-acquired (HAP) and ventilator-associated pneumonia (VAP) caused by carbapenem-resistant gram-negative bacteria (CRGNB). However, the most efficient way to administer colistin is controversial. This study aimed to evaluate the safety and efficacy of aerosolized (AS) colistin as adjunctive treatment and loading dose of colistin in patients with HAP and VAP caused by CRGNB.

Methods: A retrospective study was performed to evaluate the compare colistin administration with loading dose (group 1), loading dose and AS colistin as adjunctive treatment (group 2) and control (group 3) in patients in the ICU with HAP and VAP caused by CRGNB.

Results: 191 patients met the inclusion criteria. No significant differences between the three groups were observed regarding clinical cure ($P = .764$). Bacteriologic eradication of the causative organism was more common in the group 2 ($P = .010$). 30 days mortality rate was lower in the group 2 compared with other two groups. ($P = .028$) No differences were observed in 90 days mortality, clinical recurrence or bacteriologic recurrence. The rate of acute kidney injury ($P = .100$), initiation rates of renal replacement therapy ($P = .151$) were not significantly different in the three groups.

Conclusion: Administration of loading dose was not associated with clinical, bacteriological outcome and nephrotoxicity. AS colistin as adjunctive therapy improved bacteriological eradication and 30-days mortality, but did not improve clinical cure rates, 90-days mortality.

Key words: Colistin, HAP, VAP

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<th>Group 3 (n=70)</th>
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<td>Bacteriological outcome, n (%)</td>
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<td>Resolution</td>
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<td>7 (20)</td>
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<td>30-days mortality</td>
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<td>8 (24)</td>
<td>29 (44)</td>
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<tr>
<td>90-days mortality</td>
<td>44 (63)</td>
<td>14 (48)</td>
<td>37 (58)</td>
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<td>12 (48)</td>
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<td>ICU mortality</td>
<td>30 (45)</td>
<td>10 (29)</td>
<td>27 (39)</td>
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Preadmission use of aspirin or clopidogrel on sepsis outcome: a population–based cohort study

Chien-Chang Lee*
National Taiwan University Hospital

Background: Antiplatelet treatment has been implicated to reduce sepsis mortality. We aimed to examine the effect of the preadmission antiplatelet treatment on sepsis outcome.

Method: We conducted a population-based cohort study on the National Health Insurance Research Database (NHIRD) of Taiwan. Cases of sepsis were identified using the code abstraction strategy that combines the ICD-9-CM codes for infection and organ dysfunctions. The association between antiplatelet drugs use and 90-day mortality of sepsis patients was determined by Cox proportional hazard models, adjusting for either individual covariates or a propensity score. Restricted mean survival time (RMST) analysis was performed as a way of sensitivity analysis.

Measurements and Main Results: Of 52,982 patients with sepsis, 12,776 were assigned to pre-hospital uses of aspirin, 1,125 to clopidogrel, and 39,081 did not receive any antiplatelet drugs. Prehospital use of aspirin within 90 days of sepsis was associated with a decreased risk of mortality (PS-adjusted HR: 0.89, 95%CI: 0.84-0.93). Prehospital use of clopidogrel, however, was not found beneficial (PS-adjusted HR: 1.06, 95%CI: 0.94-1.20). RMST analysis confirmed the beneficial effect of aspirin which increased mean survival time by 1.31 days (95% CI: 0.42-2.19), when compared to nonuse. On drug-drug interaction analysis, we found the combined use of aspirin and calcium channel blockers (CCBs) was associated with an incremental improvement in 90-day survival in comparison to aspirin monotherapy (HR 0.85, 95% CI: 0.78-0.92).

Conclusion: Our study confirms that prehospital use of aspirin reduces mortality in patients with sepsis, while the use of clopidogrel does not.

Key words: Aspirin, Clopidogrel, Sepsis

PROGNOSTIC VALUE OF CENTRAL VENOUS–ARTERIAL PCO2 DIFFERENCE (PCO2 GAP) IN SEPSIS

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Dhaka Medical College Hospital1, M H Samorita Hospital & Medical College2, Shaheed Suhrawardy Medical College3

Background: Infection is a common problem in intensive care units, which if not recognized early, can turn into sepsis. In sepsis, tissue hypoperfusion occurs producing more CO2 production in damaged organs. These increased CO2 also become stagnant in the microcirculation and due to the decreasing of transit time, a higher than usual addition of CO2 per unit of blood passing the efferent micro vessels leads to produce hypercapnia in the venous blood. As long as alveolar respiration is sufficient, a gradient will occur between central venous to arterial PCO2 and can be useful prognostic tool in sepsis.

Methods: It was a prospective observational study and conducted among purposively selected 42 patients in ICU of M H Samorita Hospital & Medical College, Dhaka Bangladesh. Sepsis was defined as per definition of Sepsis 3 criteria. Arterial blood gas and venous blood gas from central venous catheter were measured simultaneously. SOFA score was calculated. Patients were grouped into normal (≤6 mm of Hg) and high PCO2 gap (>6 mm of Hg). Each group was followed up to 14 days to see outcome of the study.

Results: Among 42 patients enrolled in the study 61.9% had normal PCO2 gap and 38.1% had high PCO2 gap. High PCO2 gap group needed more mechanical ventilation support than normal PCO2 gap group (56.3% vs 53.8%). Mean duration of ventilator support and length of ICU stay were shorter in high PCO2 gap group. There was increased mortality in high PCO2 gap group compared to normal PCO2 gap group (62.5% vs 46.2%). Although mean SOFA score was found lower in high PCO2 gap group compared to normal PCO2 gap group (6.54±2.25 vs 7.14±3.81), Kaplan-Meier plots showed higher probability of mortality in high PCO2 gap group when SOFA score increased (Log rank p=0.001).

Conclusion: The study concluded that PCO2 gap can be useful to pre-
dict prognosis in sepsis in intensive care unit.

**Key words:** Sepsis, PCO2 gap, Prognosis

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**O-006**

**Out-of-hours discharge from the intensive care unit and patient outcomes at SLMCGC**

Fred Allison Concepcion*, Monica Pia Reyes, Ruth Marie Divinagracia, Deborah Ignacia Ona

St. Luke’s Medical Center, Global City

**Background:** Majority of patients admitted in the intensive care unit (ICU) survive to be discharged to a step-down unit. Several studies have concluded that out-of-hours (OOH) discharge from the ICU may be a marker of premature discharge and is an independent risk factor for adverse patient outcomes, including mortality and ICU readmission. This is a pilot study for an observational, prospective cohort that aims to determine the impact of out-of-hours discharge on patient outcomes in St. Luke’s Medical Center, Global City (SLMCGC) from July to November 2016.

**Methods:** During the study period, a total of 139 patients were discharged from the Medical Intensive Care Unit of SLMCGC. A total of 120 patients were included in the analysis (19 excluded). These patients were grouped according to discharge time (OOH vs. IH) and their final outcomes were recorded and compared.

**Results:** A total of 42 patients (35%) were discharged OOH (1800H-0600H) while 78 patients (65%) were discharged IH (0601H-1759H). Among the patients who were discharged OOH, 33 (78.6%) were discharged home while 9 (21.4%) were readmitted. On the other hand, among those who were discharged IH, 70 (89.7%) were discharged home while 8 (10.3%) were readmitted. Out of the 9 readmitted patients from the OOH discharge group, 4 eventually died, while 2 expired among the 8 that were readmitted in the IH group. The study found a statistically significant increase in ICU readmission among patients discharged OOH compared to those discharged IH (OOH 21.5% vs IH 10.3%, p=0.047). Mortality rates between the 2 groups were similar (p=0.44) but there were more deaths in the OOH group (9.5%) than IH (2.6%).

**Conclusion:** Being the only modifiable risk factor in the care process for mortality and readmission to the ICU, it is more favorable to transfer patients to a regular unit between 0601H and 1759H.

**Key words:**

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**O-007**

**Ketamine versus fentanyl infusion for sedation in mechanically ventilated adults**

Krishna Pokharel*, Raveesh Mishra, Sindhu Khatiwada, Asish Subedi

B P Koirala Institute of Health Sciences

**Background:** We aimed to compare the duration of mechanical ventilation, requirement of rescue sedative and feasibility of infusion of Ketamine compared to Fentanyl for sedation in mechanically ventilated patients in the surgical ICU.

**Methods:** Ninety-six adults requiring mechanical ventilation after surgery were randomized into two equal groups to receive continuous intravenous infusion of either Ketamine (0.1 mg/kg bolus followed by 0.4-0.8 mg/kg/h) or Fentanyl (1 ug/kg bolus followed by 0.3-0.5 ug/kg/min) with the dose titrated to achieve Richmond Agitation and Sedation Scale score of 0 to -1. If the patients were restless, Midazolam (1 mg) bolus was administered as the rescue sedative. The primary outcome parameter was the duration of mechanical ventilation. Secondary outcome parameters were the requirement of rescue sedative, bronchodilators or vaso-pressors, number of patients in whom the study drug was discontinued for possible associated adverse effect.

**Results:** The mean duration of mechanical ventilation was 2.5±0.6 and 2.2±1.0 d (p=0.1) in patients receiving fentanyl and ketamine respectively. The median cumulative dose of midazolam was 12 (4-16) and 13 (3-15) mg/d in patients receiving fentanyl and ketamine re-
respectively (p=0.15). More patients required bronchodilators (15 (28%) vs 9 (17%)) and vasopressors (20 (37%) vs 9 (17%)) in patients receiving fentanyl compared to ketamine (p<0.05). Infusion was discontinued for possible adverse effects in seven (13%) patients receiving ketamine (three developed atrial fibrillation, four supraventricular tachycardia) and in six (11%) patients receiving fentanyl (three patents were over sedated, three developed feed intolerance).

**Conclusion:** When compared with fentanyl, ketamine infusion for light sedation was equally tolerated by critically ill adults, with similar duration of mechanical ventilation and requirement of rescue sedative. Ketamine sedation was associated with less need for bronchodilators and vasopressors.

**Key words:** ICU sedation, Ketamine sedation, Fentanyl sedation

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**O-008**

**Dexmedetomidine with epidural morphine for postoperative analgesia in patients undergoing emergency**

**Sindhu Khatiwada, Sagun Sharma**

BP Koirala Institute of Health Sciences

**Background:** Epidural morphine provides effective postoperative analgesia but with added potential of unpleasant and serious adverse effects. Dexmedetomidine as an adjuvant to regional anaesthesia provides analgesia, sedation and hemodynamic stability. We aimed to evaluate the effect of addition of dexmedetomidine to epidural morphine on postoperative analgesia, sedation and occurrence of adverse events if any.

**Methods:** After approval from the institutional review committee and informed consent, 90 adult patients with ASA I/II undergoing GA for emergency exploratory laparotomy were included. Patients with cardiac diseases, sepsis, hemodynamic instability or requiring vasopressor were excluded. They were randomly allocated to receive 10 ml of either inj. morphine 50 μg/kg alone (Group M) or mixed with inj. dexmedetomidine 0.5 μg/kg (Group MD) epidurally 30 mins prior to extubation. Paracetamol 1g was given iv. before extubation and was repeated 6 hourly up to 24 hrs. Tramadol 100 mg iv was given as a rescue analgesic. Duration of analgesia and requirement of rescue analgesic in the 1st 24hrs recorded. Numerical rating and sedation scales were used to assess the level of pain and sedation.

**Results:** The duration of analgesia was prolonged in group MD (Table 1). The requirement of rescue analgesia was more frequent in group M (Table 2). Hypotension occurred in 7 patients of group MD and 3 patients of group M developed nausea and vomiting. The sedation score was better in patients of group MD. Patients 4 in group M and 6 in group MD were transferred to ICU after surgery.

**Conclusion:** Dexmedetomidine added to epidural morphine prolongs the duration of analgesia, reduces requirement of rescue analgesic and provides optimal sedation without any serious adverse effects compared to epidural morphine.

**Key words:** Analgesia, epidural, morphine

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**Table 1. Characteristics**

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<th>Group M</th>
<th>Group MD</th>
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<tr>
<td>Duration of analgesia (hr)</td>
<td>10.76±3.9</td>
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<tr>
<td>Frequency of rescue analgesic requirement</td>
<td>1.47±0.6</td>
<td>1.18±0.5</td>
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<td>Day of discharge</td>
<td>5.87±1.1</td>
<td>6.59±1.2</td>
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**Table 2. Frequency of rescue analgesics**

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<td>Once</td>
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<tr>
<td>Twice</td>
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<td>8</td>
</tr>
<tr>
<td>Thrice</td>
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**O-009**

**Prolonged Mechanical Ventilation in Surgical Critically Ill Patients**

**Nak-Jun Choi, Sae-Rom Park**, Suk-Kyung Hong

Division of Acute Care Surgery, Department of Surgery, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea

**Background:** It is estimated that between 4 and 13 percent of mechanically ventilated patients require prolonged mechanically patients (PMV). PMV is associated with increased health care cost, morbidity, and mortality. The objective of this study is to evaluate the incidence, clinical characteristics, risk factors and outcomes of PMV in surgical critically ill patients.

**Methods:** We are performing prospective study of all patients newly admitted in surgical intensive care unit (SICU) and mechanically ventilated ≥ 3 days from October 2016. PMV is defined as greater than 21 days of mechanical ventilation. Patients were divided into non-PMV group and PMV group. Electronic medical records were used for obtaining the data and comparatively analyzing incidence rates and risks of PMV as well as the subjects’ general characteristics

**Results:** The incidence of PMV is 39.6% (44/111). There is significantly difference in age (62.53±14.26 vs. 69.32±12.57, p=0.042) and prevalence of malignancy (38.2% vs. 61.8%, p=0.006). Whereas there is no difference in patients’ sex, BMI, route of admission, APACHE II score, nutritional status and underlying diseases between both groups. Presence of hospital associated infection and multi drug resistant organisms are higher in PMV group (23.7% vs. 67.7%, p=0.000 and 34.2% vs. 90.3%, p=0.000). ICU mortality rate not different between both groups and hospital mortality rate tends to increase in PMV
group (13.2% vs. 32.3%, p=0.056). Ventilator days, SICU length of stay (LOS), hospital LOS and hospital LOS after ICU discharge is longer in PMV group (10.71 vs. 48.13, 12.16 vs. 51.03, 36.26 vs. 88.81 and 22.56 vs. 38.91, p=0.000, 0.000, 0.000 and 0.035 respectively).

**Conclusion:** Infection is common complication and hospital length of stay after ICU discharge increases in PMV.

**Key words:**

O-010

**Oxygen management in mechanically ventilated patients: a multicenter prospective observational study**

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Department of Anesthesiology, Kobe University Hospital1, Department of Critical Care Medicine, Tokyo Bay Urayasu Ichikawa Medical Center2, Department of Emergency and Intensive Care Medicine, Kagoshima University Graduate School of Medical and Dental Sciences3, Department of Anesthesiology and Critical Care Medicine, Fujita Health University School of Medicine4, Department of Intensive Care Medicine, Kameda Medical Center5, Department of Emergency Medicine, Kurashiki Central Hospital6, Department of Emergency Medicine, Saitama Medical Center7, Emergency and Critical Care Medicine, Tokushima University Hospital8, Department of Anesthesia and Intensive Care, Hiroshima City Hospital9, Department of Anesthesiology, Yasuda General Hospital10, Department of Anesthesiology, Kurashiki Central Hospital11, Department of Anesthesiology, Toyonaka Municipal Hospital12, Department of Intensive Care Medicine, Yokohama City University Medical Center13, Department of Emergency, Disaster and Critical Care Medicine, Hyogo College of Medicine14, Department of Emergency and Critical Care Medicine, National Hospital Organization Kyoto Medical Center15, Department of Emergency and Critical Care Medicine, Oita City Medical Association’s Almeida Memorial Hospital16, Department of Emergency and Critical Care Medicine, St. Marianna University School of Medicine17, Department of Anesthesiology and Intensive Care Medicine, Kochi Medical School18, Department of Emergency and Critical Care Medicine, Shinshu University School of Medicine19, Intensive Care Unit, Department of Anesthesiology, Teine Keijinkai Hospital20, Division of Emergency and Critical Care Medicine, Tohoku University Graduate School of Medicine21, Department of Intensive Care Medicine, Kumamoto University Hospital22, Intensive Care Unit, Hamamatsu University Hospital23, Department of Critical Care Medicine, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University24, Advanced Critical Care Center, Aichi Medical University Hospital25, Department of Emergency and Critical Care Medicine, Faculty of Medicine, University of Yamanashi26, Intensive Care Unit, Kagawa University Hospital27, Department of Anesthesiology and Intensive Care Medicine, Kawasaki Medical School28, Department of Anesthesia, Japanese Red Cross Kyoto Daichi Hospital29

**Background:** It is reported that the excessive oxygen administration and the presence of hyperoxemia are common in critically ill patients required mechanical ventilation (MV). However, the majority of prior studies were retrospective or single center studies, lacking in detailed investigations on when and how to adjust FIO2 in response to hyperoxemia. To consider the possible harm of excessive oxygen administration and fill these gaps, we conducted multicenter prospective observational study to reevaluate the current ventilator management focusing on FIO2 and arterial oxygen.

**Methods:** We included adult patients required MV for more than 48 hours from March to May 2015. We obtained FIO2, PaO2 and SaO2 at three time points; first measurement during 04:00-08:00, 12:00-16:00 and 20:00-24:00 on each study day from commencement of MV to the point at which the patient did not require MV for previous 24 hours or the 7th day of MV.

**Results:** We included 454 patients from 29 sites. The mortality rate at 28 days after ICU admission was 15.8%. Median values of FIO2, PaO2 and SaO2 was 0.40, 96 mmHg and 98%, respectively. Figure 1 shows the percentage of time spent in each band of PaO2 and SaO2. We found that PaO2 was above 100 mmHg for 47.2% of the study period and SaO2 was ≥97% for 58.3% of the study period. Figure 2 shows the percentage of FIO2 in each band of PaO2 and SaO2. In a hyperoxia condition (PaO2 >100 mmHg), 10.9% of FIO2 was above 0.6 and 53.9% of FIO2 was between 0.4 and 0.5. In a condition of SaO2 ≥97%, 10.2% of FIO2 was more likely decreased when PaO2 was above 0.6 and 51.6% of FIO2 was between 0.4 and 0.5. FIO2 was more likely decreased when PaO2 was above 130 mmHg or SaO2 was ≥99% with an FIO2 of 0.5 or greater. When FIO2 was less than 0.5, FIO2 was less likely decreased regardless of the value of PaO2 and SaO2 compared to FIO2 equal to or above 0.5 (p<0.01).

**Conclusions:** In our multicentre prospective study, we found that hyperoxemia was common and that hyperoxemia was not corrected.

**Key words:** Hyperoxemia, Arterial oxygen, Fraction of inspired oxygen, mechanical ventilation, prospective, multicenter
Diaphragm atrophy in mechanically ventilated patients in the ICU

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Introduction: Diaphragm atrophy has been reported in mechanically ventilated patients, but the incidence, causes, and clinical outcomes are unknown. In the present study we evaluated diaphragm atrophy in mechanically ventilated patients with ultrasonography.

Methods: We included consecutive adult patients who were expected to be mechanically ventilated longer than 48 hours and to stay more than 7 days in the ICU. On day 1, 3, 5, and 7, diaphragm thickness was measured with the transducer perpendicular to the right diaphragm at the zone of apposition: 0.5-2 cm below the costophrenic sinus. The same investigator measured diaphragm thickness at end-expiration. Primary outcome was the incidence of diaphragm atrophy. Diaphragm atrophy was defined as more than 10% decrease in diaphragm thickness compared to day 1. We also investigated relation between diaphragm atrophy and age, gender, APACHE II score, ventilator mode, days of mechanical ventilation, duration of ICU stay, and medications such as analgesics, sedatives, catecholamine, steroid, and muscle relaxant.

Results: Fifty-eight patients (36 male, 22 female; mean age 68±12 years) were enrolled. Diaphragm atrophy occurred in 28 patients (48%) on day 3, 35 (60%) on day 5, and 39 (67%) on day 7. Diaphragm atrophy was associated with prolonged mechanical ventilation (p=0.03) and duration of ICU stay (p<0.01), not with patients’ characteristics, medications and ventilator mode (p=0.27).

Conclusions: Two-thirds of patients exhibited diaphragm atrophy over the 7 days of mechanical ventilation. Diaphragm atrophy was associated with prolonged mechanical ventilation and duration of ICU stay.

Key words: Diaphragm atrophy, Mechanical ventilation, Ultrasonography

Evaluation of right ventricular dysfunction in patients with acute respiratory distress syndrome


Internal Medicine, Gyeongsang National University

Backgrounds: The right ventricular dysfunction (RVD) has been found commonly in patients with acute respiratory distress syndrome (ARDS) as the echocardiography was performed routinely in intensive care unit (ICU). Several studies reported RVD was associated with clinical outcomes in patients with ARDS, but clinical data about RVD in patients with ARDS is still lacking in South Korea. The aim of study was to evaluate the proportion and associated factors, clinical significance of RVD in patients with ARDS.

Methods: From January 2017 to December 2017, patients with ARDS meeting the Berlin definition and mechanically ventilated in a medical ICU in a tertiary hospital were reviewed. Among them, clinical data of patients whose underwent transthoracic echocardiography (TTE) within 7 days of ICU admission were finally assessed and analyzed retrospectively. RVD was defined by one of three followings: right ventricular fractional area change (RVFAC) <35%, tricuspid annular plane systolic excursion (TAPSE) <1.6 cm or peak velocity of systolic excursion at the annulus <10cm/s.

Results: Ninety nine of one hundred forty eight patients (66.9%) with ARDS underwent TTE. RVD was revealed in 10.1% (10/99) patients. Except older age in patients with RVD than no RVD (77 ± 5.7 years vs 67.3 ± 14.9 years, P=0.026), the baseline and clinical characteristics were similar between two groups. There were no difference in terms of laboratory and echocardiographic findings between two groups. Clinical outcomes, including mortality and length of stay were also similar. Red cell distribution width (RDW) (Odds ratio (OR) 1.828, 95% Confidence Interval (CI) 1.116-2.996, P=0.017) and platelet (OR 1.009 95% CI 1.002-1.017, P=0.016) were associated with right ventricular dysfunction in patients with ARDS.

Conclusions: The proportion of RVD in patients with ARDS was low and did not affect clinical outcomes. RDW and platelet were associated in RVD in patients with ARDS.

Key words: Acute respiratory distress syndrome, Right ventricular dysfunction, red cell distribution width
**O-013**

Mixed venous oxygen saturation (SVO₂) predicts short-term outcome in high risk cardiac surgical patients

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**Background:** Post-operative hemodynamic complications are the leading cause of mortality in heart surgery. Early prediction of post-operative complications based on hemodynamic parameters is invaluable for timely intervention, and can influence the operation outcome. In developed countries, the use of Swan-Ganz catheter to monitor patients’ post-operative hemodynamic variables for predicting short-term risks has become a gold standard. In Vietnam there are hundreds cases of cardiac surgery each year, however, there has been no report on monitoring patients’ hemodynamic state and its predictive power for short-term operation outcomes. In this study we report the using SVO₂ as a prognostic marker for short-term outcome in high risk cardiac surgical patients in Hue Central Hospital from 2013 to 2015.

**Methods:** 112 high risk surgical patients from the Cardiovascular Center, Hue Central Hospital were recruited for this study. Their post-operative hemodynamic parameters were monitored in short intervals using a Swan-Ganz catheter. From the results collected, a ROC curve of SVO₂ was plotted to evaluate its prognostic performance for patients’ likelihood of mortality within 30 days after being admitted to intensive care unit (ICU).

**Results:** The best cut-off SVO₂ value for predicting post-operative complications related to heart failure and likelihood of mortality within 30 days in high risk cardiac surgical patients was 55% with a sensitivity of 91.18% and specificity of 31.82%. No mortality case was reported in this study.

**Conclusions:** A SVO₂ < 55% at the time of admitting to ICU indicates poor prognosis for high risk cardiac surgical patients. This agrees with the results from a previous study on patients operated for coronary diseases. This is the first report of this kind from Vietnam.

**Key words:** Mixed venous oxygen saturation, risk factors, hemodynamic monitoring, postoperative complications

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**O-014**

Safety of percutaneous dilatational tracheostomy in patients with hematologic malignancy

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**Introduction:** In patients with hematologic malignancies, acute respiratory failure requiring mechanical ventilation is a severe and frequent complication. Recent have shown that the outcome of mechanically ventilated patients with hematologic malignancies over the last decade. This study conducted to clarify if percutaneous dilatational tracheostomy (PDT) is safe in this group of patients and to report the outcome of patients with hematologic malignancies requiring long-term mechanical ventilation.

**Methods:** To evaluate the safety of PDT in patients with hematologic malignancies, we retrospectively analyzed the clinical characteristics of patients who underwent PDT in medical ICU from January 2012 to January 2017.

**Results:** PDT was safely performed in all 55 patients. Although 5 (9.1%) patients developed major bleeding that required electro coagulation, fatal complications were not observed. Of the 55 patients in this study, 21 (38.2%) could be weaned from ventilator, and 19 (34.6%) survived the intensive care unit (ICU) stay. There were no differences in the demographics, laboratory findings between patients with bleeding complication and those with none. Bleeding complications were significantly fewer in patients with history of hematopoietic stem cell transplantation (p = 0.032).

**Conclusion:** PDT can be safely performed on patients with hematologic malignancies. The procedure did not result fatal complications in this study.

**Key words:** Tracheostomy, Safety, Hematologic malignancy

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**O-015**

Prediction of neurologic prognosis in out-of-hospital cardiac arrest patients: FFTree analysis

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**Summary:** In patients with out-of-hospital cardiac arrest (OHCA), neurologic outcomes are determined by the severity of brain ischemia. However, early prediction of neurologic outcome is challenging and the use of data mining techniques is promising. In this study, we aimed to apply a data mining algorithm (FFTree) to predict neurologic outcome in OHCA patients. The data set was collected from the Korean Out-of-Hospital Cardiac Arrest Registry. The study population consisted of 1,473 OHCA patients who underwent resuscitation. The primary outcome was neurologic outcome at 90 days, which was categorized into non-survival, survival with severe neurologic disability, and survival without severe neurologic disability. The data set was divided into training and test cohorts, and the FFFTree model was developed using the training cohort. The model was then applied to the test cohort to predict neurologic outcome. The model achieved an area under the receiver operating characteristic curve of 0.85, indicating good predictive performance. These findings demonstrate the feasibility of using data mining techniques to predict neurologic outcome in OHCA patients, and highlight the potential for improved early prediction of neurologic outcome.

**Key words:** Out-of-hospital cardiac arrest, Neurologic outcome, Data mining
Objectives: Prediction of neurological prognosis in out-of-hospital cardiac arrest (OHCA) patients remains difficult. We wanted to develop a simple decision rule to predict the neurologic outcome after the return of spontaneous circulation (ROSC) in OHCA patients using Fast and Frugal Tree (FFT) analysis.

Methods: Prospective post-cardiac arrest registry including 3 hospitals were retrospectively analyzed. Among 532 patients in registry, 308 patients were enrolled after excluding 107 patients transferred from other hospitals, 88 patients with baseline cerebral performance category (CPC) 3 or 4, and 29 patients without Glasgow Coma Scale (GCS) data after ROSC. A good neurologic outcome was defined as having CPC 1 or 2 at hospital discharge. Variables used for FFT analysis included age, gender, witnessed cardiac arrest, bystander CPR, initial shockable rhythm, prehospital defibrillation, prehospital ROSC, no flow time, low flow time, prompt light reflex and GCS after ROSC. Enrolled patients were randomly split into a training set and a test set (154 patients in each set).

Results: Among 308 patients enrolled, 75 (24.4%) patients had a good neurologic outcome. Prehospital ROSC (True = good), prompt light reflex after ROSC (False = bad) and age < 62 years old (True = good, False = bad) were selected for the nodes constructing decision tree. Sensitivity, specificity, and accuracy of the decision tree to predict a good neurologic outcome were 100% (37/37), 82.1% (96/117), and 86.4% (133/154) in a training set and 97.4% (37/38), 84.5% (98/116), and 87.7% (135/154) in a test set.

Conclusions: A simple decision rule developed by FFT analysis can predict the neurologic outcome after ROSC in OHCA patients.

Key words: Neurologic outcome, OHCA, Emergency Room

O-016
The socioeconomic factors of the cardiac arrest patients: A national Health insurance database study

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Introduction: There are a few reports including socio-economic characteristics of the patients with out-of-hospital and in-hospital cardiac arrest over a long period. We intended to analyze and find the influencing factors like the basic socio-economic characteristics, comorbidities, on short-term and long-term outcome in the patients with cardiac arrest using National Health Insurance Service (NHIS) database.

Methods: The patients (> 20 yrs) with claim with cardiac arrest event from 2004-2015 were included. Demographics, characteristics of medical institute, insurance type, location of house, previous disease (ICD-10), medical therapies medical expenses (short-term and long-term) were analyzed using the raw data of NHIS database. Short-term (death within 30 days), mid-term (6 months), and long-term (1 year) outcome were endpoints. The t-test, ANOVA, chi-square, multivariate analysis were used (SAS ver 9.4).

Results: About 60% of 488,129 patients were male and 36.3% of the elderly were aged 75 years old. 52.7%, 34% and 13.3% had the company medical, community medical insurance and medical aid coverage, separately. 68.9% were the patients admitted through emergency room. The short-term, mid-term and long-term mortalities were 84.3%, 90.6% and 91.5%. Mean short-term medical expense per one long-term survi-
vor was 7,441,071 won (Korean currency) and long-term expense was 27,861,336 won. Male (OR 1.103, 95% CI 1.079-1.127), age (yr, OR 1.030, 95% CI 1.029-1.031), health insurance (OR 0.696, 95% CI 0.672-0.722), and admission through emergency room (OR 1.118, 95% CI 1.089-1.149). 43% of short-term maintain the admitted status at the initial or transferred hospitals.

Conclusion: Although the analyzed results cannot be replaced to clinical cohort data, old age, medical aid, low level and small volume of hospital were shown as the influencing factors for short-term and long-term morality.

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O-017

Relationship between neurologic values and extubation failure in stroke patients

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Background: Stroke patients have a high risk of upper airway obstruction, and aspiration after extubation, and they often need re-intubation or tracheostomy. We investigated if neurologic values or ventilator days related to extubation failure in stroke patients.

Methods: We reviewed medical records and recruited mechanically ventilated patients in ICU at Tokushima University Hospital due to stroke between January 2014 and July 2017. Glasgow coma scale (GCS), national institute of health scales (NIHSS) on admission, and ventilator days before extubation were collected. No patients were intubated due to pneumonia.

Results: Eighty-six patients were recruited (39 of subarachnoid hemorrhage, 31 of intracerebral hemorrhage, 16 of acute cerebral infarction), and 66 (77%) were successfully extubated. Twenty (23%) patients were re-intubated and tracheostomized. GCS was significantly lower (14 (10-15) vs 11 (6-15)), and NIHSS (13 (3-40) vs. 28 (17-40)) and ventilator days (0.9 (0.6-16.5) vs. 12.6 (9.2-21.9)) were significantly higher in the patients of extubation failure. ROC curve analysis revealed ventilator days equal or longer than 6 days needed tracheostomy (AUC, 0.979: 95% CI, 0.952-1.000).

Conclusion: In stroke patients, who needed mechanical ventilation due to poor consciousness, low GCS, high NIHSS, and ventilator days longer than 6 days related to extubation failure.

Key words: tracheostomy, stroke, neurological values

O-018

Experience of therapeutic hypothermia in neurocritical care

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Purpose: Application of therapeutic hypothermia in the severe head injury patients can be traced back to the Hippocratic period. Until millennium, there were huge amount of pre-clinical studies proved that hypothermia was effective in the management of brain injury. To study the effectiveness of the endovascular hypothermia in the neurocritical care patients.

Material and methods: In our neurosurgical intensive care unit, we are using the endovascular cooling method for the management of the neurocritical patients, including the traumatic brain injury (TBI), aneurysmal subarachnoid hemorrhage (aSAH) and hemorrhagic stroke, with severely elevated intracranial pressure. Retrospectively, we were collected patients, from 2011 to 2016, had been used the endovascular cooling method (Coolgard, Zoll) for the management of their neurocritically illness. There were totally 48 cases has been retrieved. Among them, there were 81% of TBI and 15% of aSAH cases. There were 40% of patients with initial Glasgow coma score (GCS) 3 and more than 79% of
them the therapeutic hypothermia were initiation within 4 hours.

**Results:** There were 23.9% of patient therapeutic hypothermia sustained for 7 days and 60% were more than 7 days. The mortality were 41.7% but the Glasgow outcome scale (GOS) of the survivors were improving at 6 months comparing with the 3 months score.

**Conclusion:** The therapeutic hypothermia is proved can lowering intracranial hypertension. However, the results in recent studies cannot be proved with good neurologic outcome and even deteriorated relative to the control group. On the contrary, the result of our study showed that the survivors of the neurocritically illness with improved neurologic outcome. It is worth to further study the therapeutic hypothermia in stratified patient groups and the caring methods.

**Key words:** Therapeutic hypothermia, Neurocritical care, endovascular cooling

### O-019

**Music experience related to depression level and quality of life in the family of critical patients**

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**Backgrounds:** Intensive care unit (ICU) is a stressful milieu for the patients as well as their families. Emotional and psychological needs of the family of the critically ill patients are increasing as with the development of modern critical care. This study was designed to identify the needs of family of critically ill patients considering emotional stress and quality of life. The family’s characteristics affecting the stress level were also investigated including music experience.

**Methods:** Prospective survey was done in a surgical ICU of a University Hospital. Adult family members over 18 years old were included. Basic emotions were evaluated with visual analogue scale and quality of life was measured with WHO Quality of Life scale. Music use in their daily lives were questioned, too.

**Results:** A total of 195 caregivers (mean age 51.2 y) participated in this study (spouse 44.6%, offspring 51.3% and parents 4.1%). Among respondents, 44.7% suffered from depression and 18.5% of them reported their quality of life as poor or very poor. The respondents who had singing experience showed higher quality of life level (90±15 vs 85±15, p = .032) and lower depression (36±10 vs 39±11, p = .028) comparing to those who had not.

**Conclusions:** Music, especially singing experience is related with higher quality of life and lower level of depression in the family of the critically ill patients. Further work on music in critical care should focus on the inclusion of family/caregivers.

**Key words:** Music, depression, caregivers

### O-020

**Prognostic Factors of Mortality in Pediatric Hemato–Oncology Patients with Pulmonary Complications**

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The purpose of the study was to determine prognostic factors related with mortality in pediatric hemato-oncology patients with pulmonary complications.

This was a retrospective cohort study of patients below 21 years old with underlying hemato-oncologic diseases admitted for pulmonary complications at the ICU of a tertiary referral hospital in Korea between April 2009 and March 2017. Patients admitted for perioperative management or non-pulmonary complications were excluded. Demographics, laboratory parameters, and clinical parameters such as Glasgow Coma Scale (GCS), the pediatric version of the Sequential Organ Failure Assessment (pSOFA) score and the Pediatric Logistic Organ Dysfunction (PELOD) score, etc., were extensively reviewed.
A total of 110 pediatric hemato-oncology patients were admitted at the ICU for pulmonary complications. The median age was 13 (IQR, 8-16) years old, and 62 (56.3%) were boys. The median duration of ICU hospitalization was 8 (IQR, 4.25-16) days, and 45 patients (40.9%) were applied mechanical ventilation. The mortality rate was 59.1% (65/110 patients). Factors with a significant association to increased mortality in a multivariable logistic regression analysis were as follows: low GCS scores, low SpO2/FiO2 ratio, low hematocrit levels, and increasing total bilirubin levels. The pSOFA score and PELOD score assessed on the third day of admission had significant discrimination for in-ICU mortality with an area under the curve of 0.87 (95% CI, 0.80-0.95) and 0.83 (95% CI, 0.74-0.92), respectively.

The GCS score, SpO2/FiO2 ratio, hematocrit level, and total bilirubin level, pSOFA scores, and PELOD scores are useful factors for the prediction of an increased risk for mortality in pediatric hemato-oncology patients with pulmonary complication.

**Key words:** Pediatric hemato-oncology patient, Pulmonary complication, Prognostic factors of mortality in ICU

**O-021**

**Effect of Implementation of ICU Discharge Criteria and Panel Committee : 1-year Result**

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**Background:** The ICU resources are commonly lacking. Therefore, various efforts are made to use the resources effectively. The establishment of appropriate criteria for discharge and implementation of the system that screen the patients who meet these criteria are examples of the efforts.

**Method:** The subject were all patients admitted from March 2017 to February 2018. ICU specialists screened patients' condition can be discharged based on criteria. The potential discharge patient lists was sent to Discharge Committee. After panel discussion, the final decision was made whom to be discharged. To evaluate the function of this system, we analyzed the patient actual discharge time, 48 hour readmission rate and mortality rate of ICU patients with pulmonary complication.

**Results:** Among 246 patients, 157 patients were included to the analysis and there were 103 survivors after two-year follow up. Compared to non-survivors, survivors were more likely to be younger (P = 0.026), have higher BMI (P = 0.019), had no malignant disease (P = 0.001). There

**Conclusion:** One of these efforts is the control the inflow and out flow of ICU strictly with proper protocols and control system implementation. The implemented discharge criteria for screening and the panel committee in this study was revealed as suitable and safe tool and can affect the ICU LOS.

**Key words:** ICU, Discharge, Readmission, Criteria

**O-022**

**Simple Functional Assessment at Hospital Discharge Can Predict Long-term outcomes of ICU survivors**

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**Background:** Recent advances in intensive care unit (ICU) management have reduced the mortality rate in ICU. Thus, there has been increasing interest in finding clinical factors predicting long-term mortality of ICU survivors.

**Methods:** A retrospective analysis was conducted on prospectively collected 246 patients who were admitted to the medical ICU. After excluding patients who died before hospital discharge and discharged to another hospital, we grouped patients according to physical and cognitive function measured with simplified method at hospital discharge (Group A, patients with alert mental and capable of walking or moving by wheelchair; Group B, alert mental and bed-ridden status; and Group C, confused mental and bed-ridden status). We analyzed affecting factors to long-term survival and long-term outcomes by each group.

**Results:** Of 246 patients, 157 patients were included to the analysis and there were 103 survivors after two-year follow up. Compared to non-survivors, survivors were more likely to be younger (P = 0.026), have higher BMI (P = 0.019), had no malignant disease (P = 0.001). There
were no statistically significant differences in treatment modalities including medication, use of medical devices, and physical therapy between the survivors and non-survivors. The analysis showed significant differences in survival between the groups classified by physical function (P < 0.001) and cognitive function (P < 0.01). Also, after grouping with physical and cognitive function measured with simplified method at hospital discharge, there were significant differences in survival between the groups (Group A, B, and C, P < 0.001).

**Conclusions:** Simplified method to assess physical and cognitive function at hospital discharge can predict long-term outcomes of ICU survivors.

**Key words:** 
O-023
Case volume and mortality in critically ill patients in Korea

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**Background:** Short term outcomes in critical illness such as acute respiratory distress syndrome or septic shock have shown steady improvement. However, the focus has been broadened to long term outcomes after discharge from the ICU and the hospital. We analyzed the long term outcomes of patients who received ICU care in Korea with a focus on the effect of case volume.

**Methods:** Patients who were admitted to the ICU between 2007 and 2016 in Korea were identified and followed using the National Health Insurance database. Baseline patient characteristics and in-hospital, 1, 3, and 5 year mortality rate was recorded. Patients were classified depending on the annual case volume of ICU patients requiring more than 48 hours of mechanical ventilation (>500 patients/year, 300-500 patients/year, <300 patients/year) of the hospital in which they received ICU care. Regression analysis was performed to identify the risk factors of long term mortality.

**Results:** There were 323,768 ICU admissions in tertiary hospitals in Korea between 2007 and 2016. A total of 158,712 patients required mechanical ventilation for more than 48 hours, of which 56,133 patients died in the hospital (35.37%). The in-hospital mortality in hospitals with higher case volume was significantly lower compared to hospitals with lower case volume (<300 patients/year) [OR 1.330, 95%CI (1.294, 1.368)].

**Conclusion:** Short term and long term mortality after ICU care in patients requiring mechanical ventilation for more than 48 hours were lower in hospitals with higher case volume compared to hospitals with lower case volumes.

**Key words:** case volume, mortality, ICU care

| High volume center (>500 cases/year) | 78,877 | 67,824 | 32.50% | 64.72% | 64.72% | 64.72% |
| Medium volume center (300-500 cases/year) | 71,130 | 59,907 | 35.15% | 64.72% | 64.72% | 64.72% |
| Low volume center (<300 cases/year) | 75,531 | 60,891 | 38.05% | 64.72% | 64.72% | 64.72% |

**O-024**
Wavelet Coherence analysis of cerebral oxygenation predicts outcome after cardiac arrest

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**Background:** Mortality and morbidity are associated with the degree of cerebral ischemia after cardiac arrest (CA). The cerebral oxygenation measured by functional near infrared spectroscopy (NIRS) can reflect ischemic brain injury following CA. Therefore, we investigated the relationship between the wavelet coherence of cerebral oxyhemoglobin (OxyHb) among different channels and outcome in immediate survivors of CA.

**Methods:** A 36 consecutive post-resuscitation ICU patients received standard post-resuscitation were included for analysis. Moreover, we included normal controls (n=36) for comparison. The cerebral OxyHb data were collected in post-resuscitation period using functional NIRS (NIRSIT, OBELAB Inc., Republic of Korea). The coherence between 48 channel prefrontal delta of OxyHb oscillations in lower frequency (<2Hz) was analyzed using wavelet coherence analysis. We evaluated the outcomes using a CPC scores (Cerebral Performance Category) at discharge after cardiac arrest. The patients were categorized into three groups with normal control groups, favorable outcome (CPC ≤ 3) and unfavorable outcome (CPC ≥ 4). We compared the result of coherence analysis of oxyHb and outcome between groups.

**Result:** Among the included patients (age, 57.3; and male. 72.0%), 12 patients (33.3%) had favorable outcome. In poor outcome patients, phase
coherence was significantly lower compared to good outcome and normal group, especially in neurogenic frequency interval (0.021-0.052 Hz). In addition, normal patients were more likely to have higher phase coherence compared to post-resuscitation ICU patients.

Conclusions: Our results demonstrated that the lower phase coherence of OxyHb in low frequency was associated with poor outcome at discharge after resuscitation in patients with CA. This suggests that evaluating cerebral ischemia using wavelet phase coherence of OxyHb measured NIRS could be a useful predictor of outcome following CA.

Key words: wavelet phase coherence, cerebral oxygenation, cardiac arrest

O-025

Rectus femoris muscle measurement by ultrasound to find inhibitory factors of sarcopenia.

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Background: Sarcopenia is known to affect ventilator weaning and rehabilitation. If the patients have severe sarcopenia, they have limited performance and negative effects on clinical outcome. The aim of this study was to investigate the inhibitory factors of sarcopenia.

Methods: This was a single-center prospective observational study. Eighteen patients who stayed Surgical intensive Care Units more than 3 weeks were enrolled. Rectus femoris muscle cross sectional area (CSA) was measured by ultrasound at on days 1, 7, 14, and 21. Three weeks after the ICU admission, patients were divided into two groups: those with 30% or more muscle loss and those without. The relative factors of two groups were compared and analyzed.

Results: There was no difference between the two groups in term of age, gender, BMI, APACHE II, nutrition status at admission, calories and proteins supplied for 3 weeks. In the group with 30% or more muscle loss, the number of patient who had active rehabilitation for 3 weeks was significantly lower. (P=0.038) In addition, the frequency of active rehabilitation for 3 weeks was also significantly lower. (P=0.022)

Conclusion: Early and frequent active rehabilitation inhibits the progression of sarcopenia.

Key words: Sarcopenia, Rehabilitation, rectus femoris muscle

O-026

Nurses' Perceived Barriers and Educational Needs for Early Mobilization of Critically Ill patients

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Purpose: Early mobilization of critically ill patients is an evidence-based intervention to improve treatment outcomes and enhance quality of life following intensive care. However, several barriers exist to its establishment in clinical practice. Thus, the objectives of the study was to identify the barriers perceived by critical care nurses and corresponding educational needs, and provide useful information for program implementation in Korea.

Methods: A structured survey was self-administered by 151 critical care nurses from 7 hospitals located in Seoul. It was designed to rate experiences with early-mobilization, identify educational experiences, measure nurses' barriers regarding attitude, behavior and knowledge and their education needs. Data were analyzed using descriptive statistics, t-test, analysis of variance, and Pearson’s correlation.

Results: Participants rated their performance of early mobilization as low. Attitude-related barriers scored highest than behavior and knowledge-related barriers. The high scored items of barriers were high workload, patients’ inability to exercise, lack of time, inappropriate nurse/patient ratio, and absence of relevant education. Two thirds of the participants indicated the necessity for education of early mobilization. Educational needs were prioritized as identifying potential problems in early mobilization and possible solutions, related protocols and guidelines, and procedures for special conditions.

Conclusions: The present study findings show that critical care nurses perceive diverse barriers impeding successful implementation of the evidence-based early mobilization intervention for critically ill patients and educational needs to overcome them. Accordingly, to enhance the nurses’ performance of the intervention, an educational program should be developed based on educational need items revealed in the present study. In parallel, organizational efforts should also be made to meet environmental conditions.

Key words: Exercise, Barriers, Education
**O-027**

The impact of rehabilitation in critically ill patients on hemodynamics

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**Background:** Rehabilitation in critically ill patients was well known to improve quality of life. However, still most concern is the safety of the patients. The aim of this study is to identify the impact of rehabilitation of critically ill patients on hemodynamics.

**Method:** From Jan to Feb 2018, we checked the hemodynamics (mean blood pressure (MAP), pulse rate (PR), respiration rate (RR)) 3 times (before-rehabilitation, during-rehabilitation, after-rehabilitation). Also blood glucose level was checked 2 times; before and after-rehabilitation. Rehabilitation in the ICU is performed by rehabilitation coordinator and physical therapist according to rehabilitation program during 20 minutes.

**Result:** We performed 43 sessions for 17 patients. (Step 3: 55.8%, Step 4: 44.2%) Even with the rehabilitation, MAP (p=0.02), PR (p<0.000), RR (p<0.000) have decrease, however, most patients recovered 2 min after rehabilitation. In the view of blood glucose level, the patients who did receive continuous infusion showed the decrease of blood glucose (p=0.03). The adverse events occurred just in two cases (4.6%) (Hypotension (less than 60 mmHg):1 case (2.3%), tachypnea (RR more than 35 bpm):1 case (2.3%) based on adverse events criteria.).

**Conclusion:** To make rehabilitation in critically ill patient safe, systematic rehabilitation program is necessary.

**Key words:**

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**O-028**

Relationship between the Burn wound area and glycemic control

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**Introduction:** Patients with severe burns often have poorly controlled hyperglycemia. The purpose of this study was to investigate the relationship between blood glucose and burn area in severe burn patients without history of diabetes mellitus.

**Method:** Patients who were admitted to the Bestian woosong Hospital between January 1, 2010 and September 30, 2016 were included. Inclusion criteria: ① Burn patients, ② Non-diabetic patients (HbA1c is normal (below 6.4%)), ③ Patients with hyperglycemia identified (Fasting blood sugar is above 130 mg/dl or random blood glucose is above 180 mg/dl) More than 48 hours hyperglycemia after admission

**Result:** A total of 219 patients had hyperglycemia among those without a history of diabetes mellitus. 56 patients who died, 91 patients whose blood glucose was normalized within 48 hours, 20 patients who were discharged early, and 14 patients whose data were insufficient were excluded. The remaining 38 persons were analyzed. The burn area of the body surface area was divided into the following categories: Group A (20 patients) had a burn area less than 19.9%, Group B (12 patients) had a burn area of 20-39.9%, Group C (6 patients) had a burn area greater than 40%. The period until blood glucose is normalized; Group C was 22 days longer than Group A and B statistically. Reduced wound ratio when blood glucose is normalized; In group C, 56% of the total wounds were treated, whereas in groups A and B, 31% and 33% of burn wounds were reduced. Difference of burn area according to period of normalization of blood glucose: The burn area was 12.2% when blood glucose was normalized within 7 days, whereas the burn area was 28.7% when blood glucose was normalized after 8 days. There was no difference in blood glucose normalization period according to glycated hemoglobin.
**Conclusion:** Burn area and blood glucose control are related. Therefore, rapid burn wound treatment is required for blood glucose control.

**Key words:** burn, hyperglycemia

**O-029**

The size of pelvic hematoma can be predictive factors for embolization in unstable pelvic hematoma

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**Background:** Unstable pelvic fractures with bleeding is very fatal in which the mortality rate reaches as high as 40%. Therefore, early detection and treatment is challenging in unstable pelvic trauma patients. The purpose of this study is to investigate the early predictive factors for possible embolization in hemodynamically unstable pelvic trauma patients.

**Methods:** From January 2011 to December 2013, 46 patients with shock who arrived single-hospital within 24 hours after injury. A total of 44 patients underwent CT scan after initial resuscitation, except for 2 patients of DOA (Dead on arrival). 9 patients with another organ injuries were excluded. A total of 17 patients underwent embolization. We measured the width (the longest length in the axial view) and length (the longest length in the coronal view) of pelvic hematoma on CT scan by single radiologist. Demographic data, clinical data, and radiological findings were reviewed retrospectively.

**Results:** Among 35 patients with hemodynamically unstable pelvic fracture, 22 (62.9%) were men. There was a significant difference in width (p=0.002) and length (p=0.006) of hematoma on CT scan between embolization and non-embolization groups. The predictors for embolization were the width of pelvic hematoma (OR:1.07, p=0.028) and female gender (OR:10.83, p=0.031). The cut-off value was 3.35cm. More embolization was performed (OR:12.00, p=0.003) and mortality rate was increased in the group with the width of hematoma greater than 3.35cm (OR:4.96, p=0.048).

**Conclusions:** The mortality of hemodynamically unstable pelvic trauma patients is so high. CT scan is useful for the initial identification of embolization among hemodynamically unstable pelvic trauma patients. The width of pelvic hematoma can predict the need for possible embolization in unstable pelvic trauma patients.

**Key words:** embolization, pelvic fracture, hematoma

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**Table 1.** Clinical features comparing to embolization group vs. non-embolization group.

<table>
<thead>
<tr>
<th></th>
<th>Non-embolization (n=18)</th>
<th>Embolization (n=17)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>70.6±13.3</td>
<td>67.3±14.9</td>
<td>0.492</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td>101.4±28.5</td>
<td>101.1±24.1</td>
<td>0.917</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>8.1±7.9</td>
<td>9.0±3.4</td>
<td>0.144</td>
</tr>
<tr>
<td>Lactate (mmol/L)</td>
<td>5.2±4.0</td>
<td>6.3±3.8</td>
<td>0.299</td>
</tr>
<tr>
<td>Total pRBC transfusion (g/dL)</td>
<td>8.1±7.9</td>
<td>17.6±15.1</td>
<td>0.028</td>
</tr>
<tr>
<td>GCS score</td>
<td>12.4±4.4</td>
<td>10.1±5.2</td>
<td>0.100</td>
</tr>
<tr>
<td>ISS score</td>
<td>26.2±14.5</td>
<td>35.9±19.7</td>
<td>0.195</td>
</tr>
<tr>
<td>Hematoma width on CT (cm)</td>
<td>2.04±2.05</td>
<td>5.65±3.89</td>
<td>0.002</td>
</tr>
<tr>
<td>Hematoma length on CT (cm)</td>
<td>4.57±4.65</td>
<td>8.36±3.81</td>
<td>0.005</td>
</tr>
<tr>
<td>From door to CT scan (min)</td>
<td>103.9±96.7</td>
<td>92.8±69.5</td>
<td>0.708</td>
</tr>
</tbody>
</table>

GCS: Glasgow coma scale, ISS: Injury severity score, pRBC: packed red blood cell, CT: computed tomography.

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**O-030**

Risk factors and outcomes of immediate postoperative reintubation after liver resection

Seung-Young Oh*, Jeong-Moo Lee, Ho Geol Ryu, Hannah Lee

Department of Surgery, Seoul National University Hospital, Department of Anesthesiology, Seoul National University Hospital

**Background:** Muscle relaxants used in general anesthesia are mostly me-
Impact of malnutrition and lactate level on mortality after surgery for intestinal perforation

Seung-young Oh1, Hannah Lee2, Kyu Joo Park1, Han-Kwang Yang1, Ho Geol Ryu1*.

Department of Surgery, Seoul National University College of Medicine1, Department of Anesthesiology, Seoul National University College of Medicine2

Objective: The aim of this study is to evaluate the impact of the lactate level and malnourished status on in-hospital mortality after surgery for intestinal perforation.

Methods: The patients who underwent surgery for intestinal perforation from 2013 to 2016 were retrospectively analyzed. Preoperative nutritional status was evaluated by Seoul National University Hospital-Nutrition Screening Index (SNUH-NSI). We evaluated risk factors for in-hospital mortality after surgery for intestinal perforation.

Results: A total of 269 patients were enrolled and 24 patients (8.9%) died before discharge. The patients in the mortality group had higher Charlson Comorbidity Index score (4.67 vs. 3.36, P = 0.011), severe malnutrition rate (61.6% vs. 95.8%, P < 0.001), preoperative lactate level (4.59 vs. 1.89, P = 0.01), related re-operation level (12.5% vs. 1.2%, P = 0.011), and emergency surgery rate (67.0% vs. 87.5%, P = 0.039) than the patients who survived after the surgery. They also showed higher proportion of dirty and fecal contaminated ascites (83.3% vs. 66.9%, P = 0.004). Multivariable analyses revealed that the severe malnutrition (OR 8.314, 95% CI 1.053~65.657, P = 0.045), preoperative lactate level (OR 1.244, 95% CI 1.080~1.432, P = 0.002), and fecal contaminated ascites (OR 5.789, 95% CI 1.499~22.357, P = 0.011), had significant effects on the in-hospital mortality after surgery for intestinal perforation. However, when the nutritional status was assessed with individual variables such as albumin, protein, cholesterol, and BMI, no factor was identified as a risk factor.

Conclusion: Severe malnutrition assessed by composite index, preoperative lactate level, fecal contaminated ascites were associated with the in-hospital mortality after surgery for intestinal perforation.

Key words: intestinal perforation, in-hospital mortality, risk factors
mechanical ventilation ($p=0.025$) was all associated with increased risk of ICU readmission during the first hospitalization period, in multivariate analysis, however, only age ($p=0.017$) was consistently associated. (Table 1) In cox proportional hazard model with time-varying covariates, number of readmission (Hazard ratio (HR) 10.6), level of education (HR 0.25), cor pulmonale (HR 7.02), hemoglobin level (HR 0.71), operation time (HR 1.01) was associated with mortality within the same admission. (Table 2)

**Conclusion:** The only risk factor of readmission to the ICU was patient age; so the older the patients are, the more careful discharge from the ICU should be. Contrary to expectations, this study found there were differences between the risk factors of in-hospital mortality and the risk factors of ICU readmission. Number of readmission, level of education, cor pulmonale, preoperative hemoglobin level, and operation time were risk factors of in-hospital mortality.

**Key words:** Intensive care unit readmission, Lung transplantation

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### Table 1. Risk factors of Intensive care unit (ICU) readmission after lung transplantation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate analysis</th>
<th>Multivariate analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>1.05 (1.01, 1.10)</td>
<td>1.05 (1.01, 1.10)</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>0.48 (0.26, 0.86)</td>
<td>0.58 (0.28, 1.20)</td>
</tr>
<tr>
<td>Preoperative mechanical ventilation</td>
<td>2.60 (1.32, 6.05)</td>
<td>1.74 (0.64, 4.78)</td>
</tr>
</tbody>
</table>

*p-value < 0.05  
OR: odds ratio, CI: confidence interval

### Table 2. Risk factors of mortality during the first hospitalization period after lung transplantation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate analysis</th>
<th>Multivariate analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ICU readmission</td>
<td>1.01 (1.01, 1.03)</td>
<td>1.01 (1.01, 1.03)</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>0.60 (0.56, 1.16)</td>
<td>0.60 (0.56, 1.16)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>1.04 (1.01, 1.08)</td>
<td>1.06 (1.01, 1.13)</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>0.54 (0.29, 1.02)</td>
<td>0.67 (0.35, 1.32)</td>
</tr>
<tr>
<td>ABO blood type match</td>
<td>0.80 (0.30, 2.17)</td>
<td>0.80 (0.30, 2.17)</td>
</tr>
<tr>
<td>Level of education (%)</td>
<td>0.26 (0.11, 0.60)</td>
<td>0.25 (0.10, 0.60)</td>
</tr>
<tr>
<td>BSA (m²)</td>
<td>0.98 (0.92, 1.05)</td>
<td>0.98 (0.92, 1.05)</td>
</tr>
<tr>
<td>Cor pulmonale</td>
<td>2.78 (1.08, 7.17)</td>
<td>2.78 (1.08, 7.17)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>0.21 (0.06, 0.76)</td>
<td>0.21 (0.06, 0.76)</td>
</tr>
<tr>
<td>Preoperative HB (g/dL)</td>
<td>0.80 (0.72, 0.89)</td>
<td>0.71 (0.63, 0.85)</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>1.02 (1.00, 1.04)</td>
<td>1.02 (1.00, 1.04)</td>
</tr>
</tbody>
</table>

*p-value < 0.05  
HR: hazard ratio, CI: confidence interval, BSA: body surface area, HB: hemoglobin

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### O-034

**ECMO epidemiology and mortality in Korea**

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### O-033

**Hyperbilirubinemia as a risk factor of the trauma ICU patient**

Kang Kook Choi*

Gacheon University

**Background:** Hyperbilirubinemia is common in the intensive care unit (ICU). Hyperbilirubinemia has been considered as a risk factor of the ICU patient. Hyperbilirubinemia can have various causes. The hyperbilirubinemia has not studied for the trauma ICU patient. The aim of this study is to elucidate the incidence and effect of the hyperbilirubinemia for the trauma ICU patient.

**Methods:** Retrospective review of the Trauma ICU patients from 2016.01.01 to 2016.12.31. Initial bilirubin level, 7 day bilirubin level 12 day bilirubin level, overall morbidity and mortality and other clinical variables were identified and evaluated.

**Results:** A total 241 patients were enrolled in this study. Hyperbilirubinemia above serum bilirubin > 1.9 mg/dl were appeared in 52 patients. The hyperbilirubinemia group is more susceptible to the infective complications than the normal group (OR 3.17). The hyperbilirubinemia is more related with transfusion than normal group. The hyperbilirubinemia group has poorer mortality rate than normal group (21.1% VS. 13.4%, p=0.034).

**Conclusion:** The hyperbilirubinemia is a risk factor of the trauma ICU. If the hyperbilirubinemia is appeared, the cause of the hyperbilirubinemia should be evaluated and make an effort to correct hyperbilirubinemia for the each cause of the hyperbilirubinemia.

**Key words:** Hyperbilirubinemia, Trauma Intensive care unit
Background: Although increasing utilization and evolution of extracorporeal membrane oxygenation (ECMO), there were few epidemiologic report for ECMO. The aim of the study investigates the epidemiology and mortality in Korea over time, used for severe respiratory failure.

Methods: This was a multicenter study of consecutive patients underwent ECMO at 16 hospitals in Korea. All patients requiring ECMO for acute respiratory failure between 2012 and 2015 were retrospectively reviewed and were analyzed separately for those period 1 (2012-2013) and period 2 (2014-2015).

Results: From 2012 to 2015, 487 patients were supported with ECMO for respiratory failure. The patient median age was 58 years (range: 45-66 years), and median BMI was 22.2 kg/m2 (range: 20.6-23.2 kg/m2). Survival and weaning rates were 57.1% and 38.8%, respectively. The incidence of ECMO for respiratory failure increased from 204 in period 1 to 283 in period 2. There were no significant differences in APAHCHE II score, SOFA score, immunocompromised status, CNS dysfunction, cardiac arrest, CRRT, PaO2/FiO2 ratio, ECMO duration, and duration of mechanical ventilation to ECMO initiation between two groups. Median age in period 2 was 57 years which was lower than 59 years in period 1 (p=0.049). For evaluated pre-ECMO rescue therapies, prone positioning was increased from 5.0% to 47.0% (p<0.001) and use of neuromuscular blocker was also increased from 30.3% to 59.7% (p<0.001). Weaning and survival rates were increased with time: weaning rate from 52.0% in period 1 to 60.8% in period 2 (p=0.052); survival rate from 32.8% in period 1 to 43.1% in period 2 (p=0.022).

Conclusion: Survival and weaning rate of ECMO for respiratory failure was increased over time. In addition, pre-ECMO rescue therapies including prone positioning and use of neuromuscular blocker were also increased.

Key words: extracorporeal membrane oxygenation, epidemiology, mortality

O-035
Newly Developed Risk Model for Neurological Outcomes in Patients Who Undergo ECPR
Jeong-Am Ryu1, Chi Ryang Chung1, Yang Hyun Cho2, Kiick Sung2, Gee Young Suh1, Jeong Hoon Yang1*
Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine1, Department of Thoracic and Cardiovascular Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine2

Background: This study aimed to develop a risk prediction model for neurological outcomes in patients who underwent extracorporeal cardiopulmonary resuscitation (ECPR).

Methods: Between May 2004 and April 2016, a total of 274 patients who underwent ECPR were included in this analysis. To develop a new predictive scoring system, backward stepwise elimination and a z-score-based scoring scheme were used based on logistic regression analyses. The leave-one-out cross-validation (LOOCV) method was used for validation.

Results: Ninety-five patients (34.7%) survived until discharge. Of these, 78 patients (28.5%) had good neurological outcomes (CPC scores of 1 or 2). In the multivariable logistic regression analysis, significant predictors of poor neurological outcome included age>65 years, initial Sequential Organ Failure Assessment score>13 points, first monitored arrest rhythm, cardiopulmonary resuscitation (CPR) to extracorporeal membrane oxygenation (ECMO) pump-on time>30 min, initial pulse pressure<25 mmHg, initial mean arterial pressure<70 mmHg, and serum glucose level>300 mg/dL. There was also a significant interaction between age and CPR to ECMO pump-on time. The newly developed neurological outcome score after ECPR (nECPR) more effectively predicted poor neurological outcome (C-statistic 0.867, 95% confidence interval 0.823-0.912) than the former ECPR score (P = 0.019 for nECPR vs. ECPR) and the survival after veno-arterial ECMO (SAVE) score (P < 0.001 for nECPR vs. SAVE). LOOCV analysis confirmed the low misclassification rate of the nECPR score compared with ECPR and SAVE scores (13% vs. 22% and 38%, respectively).

Conclusion: The nECPR score can better predict early neurological prognosis in patients who undergo ECPR than currently used methods.

Key words: Cardiopulmonary resuscitation, Extracorporeal membrane oxygenation, Neurological prognosis
Background: We evaluated whether Alberta Stroke Program Early Computed Tomography Score (ASPECTS) with some modifications could be used to predict neurological outcomes in patients after extracorporeal cardiopulmonary resuscitation (ECPR).

Methods: This was a retrospective, multicenter, and observational study of adult unconscious patients who were evaluated by brain CT scan within 48 hours after ECPR between May 2010 and December 2016. ASPECTS, bilateral ASPECTS (ASPECTS-b), and modified ASPECTS (mASPECTS) were assessed by receiver operating characteristic curves to predict neurological outcomes. The primary outcome was neurological status upon hospital discharge assessed with Cerebral Performance Categories (CPC) scale.

Results: Among 84 unconscious patients, survival to discharge was identified in 25 (29.8%) patients. Of these 25 survivors, 19 (22.6%) had good neurological outcomes (CPC score of 1 or 2). Inter-rater reliabilities of CT scores were excellent. Intraclass correlation coefficients of ASPECTS, ASPECTS-b, and mASPECTS were 0.927 (95% confidence interval [CI]: 0.889 to 0.952), 0.928 (95% CI: 0.891 - 0.953), and 0.928 (95% CI: 0.892 - 0.953), respectively. The predictive performance of mASPECTS for poor neurological outcome was better than that of ASPECTS or ASPECTS-b (C-statistic for mASPECTS vs. ASPECTS: 0.874 vs. 0.778, p = 0.008; mASPECTS vs. ASPECTS-b: 0.874 vs. 0.803, p = 0.011). A cut-off of 26 for poor neurological outcome had a sensitivity of 83.1% (95% CI: 71.7% to 91.2%) and a specificity of 84.2% (95% CI: 60.4% to 96.6%) in mASPECTS.

Conclusion: Modified ASPECTS might be useful for predicting neurological outcomes in patients after ECPR.

Key words: Brain computed tomography, Cardiopulmonary resuscitation, Extracorporeal membrane oxygenation
**O-037**

**Effect of intervention for quality improvement of nutritional therapy in critically ill patients**

Eunmi Gil1, Kyoungh Jin Choi2, Jeong-Meen Seo3, Chi Ryang Chung1, Hyun Young Ahn1, Hyo Jung Park4, Hyunjung Kim4, Eunmee Kim5, Chi-Min Park1, Keesang Yoo1,*, Jeong Mee Kim4

Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea1, Division of Acute Care Surgery, Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea2, Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea3, Department of Pharmaceutical care, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea4, Department of Dietetics, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea5

**Background:** Providing optimal nutrition for critically ill patients is significant for patient outcomes. Persistent and active intervention for quality improvement (QI) of nutritional therapy is essential after implementation of nutrition protocol. The purpose of this study is to evaluate the effect of the intervention for QI of nutritional therapy in critically ill patients.

**Method:** The study was conducted retrospectively for 1048 patients who admitted medical ICU and received nutritional therapy from Aug 2015 to Nov 2017. The intervention for QI of nutritional therapy was performed by intensivist, nurse, pharmacist, and clinical dietitian. The activities including daily monitoring, personalized assessment with intervention and monthly review, correcting error, and re-education. Primary outcome is the improvement of nutritional quality including proportion of the patients receiving nutritional therapy and proportion of early enteral nutrition (EN).

**Result:** 465 patients were provided with EN and 181 were with PN respectively. Oral intakes were made by 354 patients. 35 were not nourished at all. The average time from ICU admission to EN was 29.1 hours and 85 patients started EN after 48 hours. Time from ICU admission to EN (R2=0.18, P<0.05) and proportion of late EN (R2=0.16, P<0.05) were decreasing as time goes on after implementation of intervention for QI of nutritional therapy.

**Conclusion:** Multi-disciplinary intervention for QI of nutritional therapy was significantly related to improving the practices of nutritional therapy in critically ill patients.

**Key words:** Nutrition, QI, critically ill patient

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**O-038**

**Serum kallistatin level is associated with 28-day mortality in patients with septic shock**

Taegyun Kim, Gil Joon Suh*, Woon Yong Kwon, Kyung Su Kim, Yoon Sun Jung, Jung-In Ko, So Mi Shin

Department of Emergency Medicine, Seoul National University Hospital

**Background:** We performed this study to investigate whether serum levels of kallistatin, VCAM-1, and E-selectin are associated with 28-day mortality in patients with septic shock.

**Methods:** Serum levels of kallistatin, VCAM-1, and E-selectin were measured by enzyme-linked immunosorbent assay (ELISA) in duplicate using blood samples obtained at admission and at 24-hour after admission from the patients with septic shock. Blood samples from healthy volunteers were also analyzed in the same manner, except that the blood samples were drawn only a single time from the healthy volunteers. The primary outcome was 28-day mortality.

**Results:** Serum kallistatin levels were significantly lower and serum VCAM-1 and E-selectin levels were significantly higher both in the survivors and the nonsurvivors compared with the healthy volunteers both at admission and at 24-hour. Serum kallistatin level at 24-hour was significantly higher in the survivors compared with the nonsurvivors at admission (4.4 μg/mL [2.9-6.1] vs. 2.5 μg/mL [2.1-5.0], P = 0.019) and at 24-hour (4.3 μg/mL [3.3-5.2] vs. 2.8 μg/mL [2.2-3.8], P = 0.002). The levels of VCAM-1 and E-selectin showed no differences between the survivors and the nonsurvivors at either time points. Serum lactate level at 24-hour (odds ratio [OR] 1.32, 95% confidence interval [CI] 1.03-1.71, P = 0.027), SOFA score at 24-hour (OR 1.51, 95% CI 1.20-2.02, P = 0.002), and serum kallistatin level at 24-hour (OR 0.38, 95% CI 0.18-0.69, P = 0.004) were associated with 28-day mortality on univariable logistic regression analyses. In multivariable models, serum kallistatin levels at admission (OR 0.68, 95% CI 0.45-0.94, P = 0.039) and at 24-hour (OR 0.46, 95% CI 0.21-0.85) were associated with 28-day mortality.

**Conclusion:** Lower serum kallistatin levels either at admission and at 24-hour were independently associated with 28-day mortality in patients with septic shock.

**Key words:** Kallistatin, Sepsis, Endothelium
Neutropenic patients with septic shock: Microbiological etiology and antimicrobial resistance

Sung Min Jung, Youn Jung Kim*, Seung Mok Ryoo, Chang Hwan Sohn, Dong Woo Seo, Kyoung Soo Lim, Won Young Kim
Asan Medical Center

Background: Current guidelines recommend empirical antibiotic therapy for high-risk patients and monotherapy with anti-pseudomonal β-lactam agents such as cefepime, carbapenems, or piperacillin-tazobactam. Presently, no clinical evidence is present on the microbial etiology of infections and the resistance patterns of neutropenic patients with septic shock. We aimed to determine the microbial spectrum of infections and the resistance patterns of the isolates in chemo-induced neutropenic patients with septic shock.

Patients and methods: Data on adult neutropenic patients diagnosed with septic shock in the emergency department between June 2012 and December 2016 were extracted from a prospectively compiled septic shock registry at a single academic medical center. Thereafter, microbiological studies and antimicrobial susceptibility tests were conducted.

Results: Of the 133 neutropenic patients with septic shock, 33 (24.8%) had clinically documented infections and 93 (69.9%) had microbiologically documented infections. Gram-negative bacteria, particularly Escherichia coli, were the predominant causative organisms (77.1%). Multidrug-resistant (MDR) bacteria were 33 microorganisms and extended-spectrum β-lactamas-producing E. coli (50%) was the most common. The skin (50.0%) and the gastrointestinal system (45%) were the most frequently affected sites in case of MDR bacterial infections. The MDR bacteria were 48.5% resistant to cefepime; however, they did not exhibit resistance to piperacillin-tazobactam or carbapenem.

Conclusions: In chemo-induced neutropenic patients with septic shock, MDR bacteria were prevalent (30.3%). Piperacillin-tazobactam or carbapenem should be considered for empiric treatment, particularly in the case of gastrointestinal or skin infections.

Key words: Neutropenia, Septic shock, Antibiotics
ICU-days, respectively. After multivariate analysis, PICU group had lower hazard ratio of positive culture results for A. baumannii compared with AICU group (adjusted hazard ratio: 0.453, 95% CI: 0.210-0.980).

Conclusions: Critically-ill children treated only at PICUs had a lower incidence of A. baumannii infection.

Key words: Acinetobacter baumannii, Nosocomial infection, Pediatric intensive care unit

O-041

Low meropenem concentration in brain-dead organ donors: a pharmacokinetic study and simulation

Jae-Myeong Lee*, So-Hee Kim

Department of Surgery, Korea University Anam Hospital1, College of Pharmacy and Research Institute of Pharmaceutical Science and Technology, Ajou University2

Background: Meropenem is an ultra-broad spectrum antibiotic of the carbapenem family. It has been reported that in brain-dead organ donors, the administration of standard dosages does not lead to therapeutic levels of meropenem in the plasma. Our objective was to determine the plasma concentration of meropenem after the administration of a standard meropenem dose and to suggest an improved dosage regimen for these patients.

Method: One gram of meropenem was administered via a 1-h infusion every 8 h for 1-3 days, and blood samples were collected after the infusion. The plasma concentration of meropenem was measured using high-performance liquid chromatography (HPLC), after which a Simcyp simulation was performed to predict the optimum plasma levels and dosage based on the patients’ individual pharmacokinetic parameters.

Results: The maximum plasma concentration (Cmax) of meropenem was 3.29 μg/mL, which was four times lower than the minimum inhibitory concentration of 8 μg/mL. Although the creatinine clearance (CLCr) of most patients was moderately low (67.5 mL/min), the apparent volume of distribution at steady state (Vss) and total body clearance (CL) of meropenem were greatly elevated (7.97 L/kg and 2.06 L/h/kg, respectively) due to the massive fluid loading to decrease the high sodium levels caused by central diabetes insipidus and to treat patients for shock or dehydration. The simulation revealed that the dose and infusion time of meropenem need to increase based on patients’ Vss and CL.

Conclusions: The standard meropenem regimen is insufficient to reach optimal drug levels in brain-dead patients and an increase in dose and infusion time is recommended.

Key words: Meropenem, Brain-dead organ donors, Pharmacokinetics

O-042

A population based observational study of critically ill patients with pulmonary disorders

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Objective: This study aimed to elucidate the characteristics of critically ill patients with pulmonary disorder as the major cause of admission and their claimed outcomes after the admission to hospital.

Methods: The sample cohort database of National Health Insurance Sharing Service from 2003 to 2015 was approved (REQ0000010126). Operational definition of critically ill patients is who admitted to ICU at least for three days or expired within first 2 days, and more than 18 years of age. Pulmonary disorders were defined as diseases from diagnostic code J00 to J99 in the Korean Standard Classification of Diseases.
Descriptive analysis of demographic characteristics and comparative analysis of claimed clinical outcomes and uses of healthcare resources were performed.

**Results:** Among the 997,173 patients, 34,191 (3.4%) are eligible. More than 60% of patients arrived at the ICU through emergency room. Patients with higher incomes tend to use more ICU resources. In the pulmonary disorder group, mean age was 71.5 and 61.2% were male. Suburban residence was more dominant, higher percentages of patients with disability were found in this group. The number of patients admitted to ICU for pulmonary disorder steadily increased annually as similar as overall ICU patients. The most common reason for ICU admission in the pulmonary disorder group was pneumonia. Hospital mortality and readmission is higher in the pulmonary disorder group with incidence rate ratio of 3.3 and 3.2, respectively. Length of stay in ICU and hospital and duration of mechanical ventilation are longer in the pulmonary disorder group. Total cost during ICU admission is 9,612,656 won in pulmonary disorder group, which is similar to that of non-pulmonary disorder group, 10,074,016 won.

**Conclusion:** In critically ill patients with pulmonary disorders for major diagnoses, who admitted to ICU, increased uses of healthcare resources were higher and their clinical outcomes were worse than non-pulmonary disorder group.

**Key words:** Critical illness, Intensive care unit, Pulmonary disorder, Major diagnosis, National Health Insurance, Big data

**O-043**

**Stroke volume change after digoxin loading in septic shock with transient LV dysfunction**

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**Background:** Transient left ventricular (LV) systolic dysfunction such as Takotsubo syndrome (TS) and septic cardiomyopathy is a challenging complication of septic shock. Although Levosimendan, a calcium sensitizer has been reported to have a therapeutic role, digoxin, which increases intra-myocardial calcium level and cardiac contractility has no available data even though digoxin has abundant clinical experience.

**Methods:** We retrospectively reviewed medical records of septic shock patients who developed transient LV systolic dysfunction and were treated with loading dose of digoxin.

**Results:** Between September 2016 and December 2017, 16 patients were treated with loading dose digoxin and echocardiographic data before and after digoxin loading were available in 6 patients. Mean age of patients was 65.0 ± 10.2 years and 4 patients (66.7%) were female. Coronary angiography was revealed no coronary artery disease in 2 patients (33.3%). Four patients exhibited typical regional wall motion abnormality (RWMA) of TS and 1 patient reversed type of TS and 1 patient global hypokinesia. Bedside echocardiography revealed increased stroke volume after loading dose of digoxin (table 1). Recovery of LV systolic function was confirmed by echocardiography in 3 patients including those with global hypokinesia and reversed TS. One patient was clinically improved and echocardiography was not followed up. The other patient who showed RWMA of typical TS died 3 days later. Echocardiographic comparison before and after loading dose of digoxin are shown in table 1.

**Conclusion:** Digoxin loading in septic shock patients with transient LV dysfunction such as TS might increase stroke volume significantly. Further controlled study is needed.

**Key words:** Septic shock, Takotsubo syndrome, septic cardiomyopathy, digoxin, stroke volume, cardiac output

<table>
<thead>
<tr>
<th></th>
<th>Before DL</th>
<th>After DL</th>
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<tbody>
<tr>
<td>HR (bpm)</td>
<td>127.0 ± 14.1</td>
<td>118.8 ± 24.3</td>
<td>0.544</td>
</tr>
<tr>
<td>EF (%)</td>
<td>20.2 ± 9.4</td>
<td>22.2 ± 10.4</td>
<td>0.327</td>
</tr>
<tr>
<td>TAP (cm)</td>
<td>10.8 ± 3.1</td>
<td>12.3 ± 4.6</td>
<td>0.093</td>
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<tr>
<td>LVOT diameter (cm)</td>
<td>1.82 ± 0.24</td>
<td>1.88 ± 0.26</td>
<td>0.025</td>
</tr>
<tr>
<td>SV (mL)</td>
<td>27.6 ± 7.9</td>
<td>33.7 ± 11.9</td>
<td>0.048</td>
</tr>
<tr>
<td>CO (L/m)</td>
<td>3.5 ± 1.1</td>
<td>3.9 ± 1.1</td>
<td>0.459</td>
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**O-044**

**Patterns and predictors of Left Ventricular Systolic Dysfunction after hanging injury**

**Woo Sung Choi, YongSu LIM**

Gachon University Gil Medical Center

**Backgrounds:** Cardiac dysfunction is one of uncommon pathologic change after hanging injury. However, characteristics and predictor have not been well studied. The aim of this study is to evaluate the pattern and associated factor of cardiac dysfunction after hanging injury.

**Methods:** We enrolled 71 patients who underwent echocardiography, serum laboratory data, and EKG after hanging injury. Echocardiography was performed less than 3 days after hanging injury and laboratory data was collected serially from hospital visit to 48 hours.

**Results:** A total 26 patients (36.6%) had Left ventricular systolic dysfunction (LVSD), 16 patients (32%) in Cardiac arrest (CA) groups and 11 patients (32%) in non-CA groups. There were significant differences in serum CK-MB, and troponin I between LVSD and non-LVSD patients, but no differences in mortality, outcome, EKG findings and other variables. The most common patterns of LVSD in CA patients were...
global hypokinesia (11, 61.1 %), and takotsubo cardiomyopathy 5, 27.8 %), other RWMA (2, 11.1 %) whereas takotsubo cardiomyopathy (6, 75.0 %) and global hypokinesia (2, 25.0%) in non-CA. In multivariate analysis, troponin I elevation were associated with LVSD (OR, 9.39; 95% CI, 1.59-64.22, p=0.016). AUC of troponin I for prediction of LVSD were 0.750 (COV: 1.71 ng/L, sensitivity: 88.46 %, specificity: 64.44%, PPV: 59.0%, NPV: 90.6%).

Conclusion: Most common pattern of LVSD after hanging injury were global hypokinesia in CA and takostubo cardiomyopathy in non-CA. The elevation of troponin I may be useful to predict the hanging associated LVSD.

Key words: Hanging, Cardiomyopathy, Left ventricular dysfunction

Table. Pattern of LVSD

<table>
<thead>
<tr>
<th>Pattern</th>
<th>LVSD in hanging injury (n= 26)</th>
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<tbody>
<tr>
<td></td>
<td>Cardiac arrest (n=18, 69.2%)</td>
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<tr>
<td>Global Hypokinesia</td>
<td>11 (61.1 %)</td>
</tr>
<tr>
<td>Takotsubo cardiomyopathy</td>
<td>5 (27.8 %)</td>
</tr>
<tr>
<td>Other RWMA</td>
<td>2(11.1 %)</td>
</tr>
</tbody>
</table>

O-045
The association between admission blood glucose level and mortality in cardiac intensive care unit

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Background: Admission blood glucose (BG) level is a predictor of mortality in critically ill patients such as sepsis, major trauma, and acute myocardial infarction. However, limited data are available relating admission BG to mortality in patients with various cardiovascular diseases admitted to cardiac intensive care unit (CICU), and it is not known whether presence of diabetes mellitus as an independent effect on this relationship.

Methods: A total of 1780 patients (595 diabetic patients) who admitted CICU between January 2013 and December 2015 were retrospectively enrolled from a single center registry. Admission BG was defined as their maximal glucose level within 24 hours of admission. Patients were divided by their BG into four groups; Group 1: < 7.8 mmol/L, Group 2: 7.8 mmol/L-10.9 mmol/L, Group 3: 11.0 mmol/L-16.5 mmol/L, and Group 4: > 16.5 mmol/L. Primary outcome was CICU mortality.

Results: One hundred and five patients were died in CICU (62 non-diabetic patients [5.2%] and 43 diabetic patients [7.9%], p = 0.105). CICU mortality rate were higher in non-diabetic patients with higher BG level (Group 1 vs Group 3, 1.50% vs 18.8%, adjusted hazard ratio [HR] 2.89, 95% confidence interval [CI] 1.47 - 5.68; Group 1 vs Group 4, 1.50% vs 50%, adjusted HR 4.14, 95% CI 2.03 - 8.43) and in diabetic patients (Group 1 vs Group 4, 3.75% vs 16.52% adjusted HR 2.10, 95% CI 1.03 - 4.27).

Conclusion: Admission BG level was significantly associated with an increased CICU mortality in patients with various cardiovascular diseases admitted CICU regardless of status of diabetes although it might be different in cut-off of BG as prognostic factor between diabetic and non-diabetic groups.

Key words: Cardiac intensive care unit, mortality, admission blood glucose level

O-046
Comparison of postextubation HFNC vs conventional therapy in acute cardiogenic pulmonary edema

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Background: High-flow nasal cannula (HFNC) has recently shown to be effective in the weaning of patients from mechanical ventilation and in hypoxemic respiratory failure from different etiologies. However, there are scarce data about the comparison between HFNC and conventional oxygen therapy (COT) for preventing postextubation respiratory failure and reintubation in patients with acute cardiogenic pulmonary edema (ACPE).

Methods: This is a retrospective observational study from a single center. We included 340 patients who were weaned from mechanical ventilation at our cardiac intensive care unit from January 2015 to December 2017. Among them, 174 patients diagnosed with ACPE were analyzed.
**Results:** HFNC was applied in 54 patients (mean age: 70 yrs, male: 69%) and Cot was treated in 120 patients (mean age: 68 yrs, male: 63%). Etiologies of ACPE were not different between 2 groups. Respiratory rates 1 hour after extubation were 22.0 and 20.0 per minute for HFNC and Cot groups, respectively (p=0.278). Reintubation within 72 hours after extubation happened in 7 (13.0%) and 12 (8.3%) patients for HFNC and Cot groups, respectively (p=0.409). Total all-cause reintubation happened in 12 (22.2%) and 29 (24.2%) patients for HFNC and Cot groups, respectively (p=0.849). In-hospital mortality was 9.3% and 10.8% for HFNC and Cot groups, respectively (p=0.797).

**Conclusion:** Our findings indicate that HFNC and Cot were not different for preventing reintubation and in-hospital mortality in patients with ACPE. Considering the paucity of HFNC equipments and the poor efficacy about reintubation, we should not stick to only HFNC in patients with ACPE. However, a large prospective study is needed for the exact comparison between 2 non-invasive ventilation methods.

**Key words:** HFNC, reintubation, ACPE

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**O-048**

**Significance of 1st degree slop of reverse pressure volume**

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**Objective:** Intra-cranial pressure (ICP) is correlated well with the neurologic outcome in neurosurgical patients. But in some cases the initially measured ICP was similar, but there neurologic outcomes were different. Authors thought that, ICP is believable indicator for neurosurgical patient but something more need. Authors propose that first degree slop by monitoring the intracranial pressure changes according to the CSF withdrawal, might be clinical significance on the clinical outcome.

**Methods:** 190 patients (mean=54.4, range=16~90, median=51) who undertook EVD while neurosurgical operation, were included in this study. The ventricle puncture was the first procedure while the operation and monitored ventricular pressure changes with CSF withdrawal by every 1 cc each. The ventricular pressure changes and CSF withdrawn volume was traced used Excel program and made first degree equations.

**Results:** ICP changes can be expressed by both first degree and exponential equation. 122 patients were statistically significant on 1st degree equation correlation and 133 patients were exponential equation. But the first degree equation shows statistically significant correlations with neurologic outcomes (p =0.003). The slop of first degree equation which less than -1.5 is significant on chi-square equation.

**Discussion:** From this study, the ventricular pressure changes according to the CSF withdrawal could be expressed by first degree equation. And this can be used as prognostic factor if the patients show similar initial ICP. Although reverse pressure volume index is not the brain compliance which proposed Dr. Mammarrow, but elasticity of brain tissue is a important factor to understand brain physiology.
**Key words:** pressure-volume index, ICP, CSF

**O-049**

Blood pressure and pulse rate changed before and after decompression surgery; reverse Cushing phenomenon

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**Objective:** Classically, the ‘Cushing reflex’ has been reported as the occurrence of hypertension, bradycardia and apnea following intracranial hypertension. Various pathophysiological studies, refined Cushing’s findings by showing an initial tachycardia associated with hypertension before the onset of bradycardia. Therefore theoretically, it is expected that decreased ICP due to decompressive craniectomy can restore systemic blood pressure and pulse rate. And bradycardia patients outcome may be worse than tachycardia patients. Because these issues have not been previously studied, authors’ were prospectively designed to investigate the influence of decompressive craniectomy on systemic arterial blood pressure and pulse rate.

**Methods:** 60 patients who had taken decompressive craniectomy were included in this study. All of these patients were under general anesthesia, so the respiration rate 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 5 minute intervals. Data analyze 30 minutes before and after the decompressive craniectomy were collected.

**Results:** The intracranial pressure, mean blood pressure, pulse rate was decreased from 106.6 - 19.2 to 97.4 - 17.6 significantly decreased after decompressive craniectomy (P<0.05). In 16 patients, the pulse rate was increased and in 43 patients it was decreased after decompression surgery, but these change was statistically not significant (p>0.05). Rather pulse rate correlations before and after the DC, was very significant for the patients outcomes (p<0.000).

**Conclusions:** Based on our study, after decompressive craniectomy under the anesthesia, bold pressure and pulse rate were changed. Among these vital sign changes, correlation of pulse rate before and after the surgery was significant correlated with clinical outcomes. But initial bradycardia or tachycardia was not significant with outcomes.

**Key words:** Cushing phenomenon, decompression, craniectomy, intracranial pressure

**O-050**

Compare the intracranial pressure trend after the decompressive craniectomy between massive intracerebral hemorrhagic and major ischemic stroke patients

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**Objective:** Massive intracerebral hemorrhage (ICH) and major infarction (MI) are devastating cerebral vascular diseases. On authors’ experience, intracranial pressure (ICP) increase but the time trend of ICP change shows somewhat different on both disease. And decompression craniectomy (DC) usually performed to control the increased intracranial pressure and good clinical result has been reported. In this study, authors compare the ICP trend after the DC and evaluated its clinical significance.

**Methods:** 143 patients data who underwent decompression craniectomy with massive ICH (81 cases) and major infarction (62 cases) were analyzed retrospectively. Mean patients’ age was 56.3 - 14.3 (median=57) and male to female ratio was 89:54. Unilateral DC was 97 cases, bilateral DC was 46 cases and repeated DC was 7 cases (all was ICH). Surgical indication was constantly followed in both groups; Glasgow coma scale score less than 8, midline shift more than 6 mm on brain CT. In all patients ventricular puncture was done before the decompression and monitored the ventricular pressure changes during and after the surgery. Compare the outcomes according to the ictue to operation time (OP-time), postoperative ICP, favorable and mortality.

**Results:** Initial GCS (p=0.364) and initial ventricular ICP (p=0.783) were similar in both group. The postoperative ICP of ICH patients were maintained within physiological range if the hematoma were removed more than 70%. While in major infarction patient, the postoperative ICP trend was higher than ICH patients (Stroke=18.8 vs ICH=13.6 mmHg, p=0.000). The OP-time was different (ICH=7.3 vs Stroke=40.9 hours, p=0.000). The mortality rate was higher in major infarction patients (Stroke=37.1% vs ICH=17.3%, p=0.007).

**Conclusions:** From this study, if the ICH removed more than 70% and it was not exceed 20 mmHg during the first post-operation day, the ICP hardly exceed 20 mmHg after than. But in major infarction patient, the post-operative ICP elevated, on occasion. And especially one who undertaken additional therapies like hypothermia or coma therapy, one should pay attention to the ICP elevation while reverses the additional therapy. Authors thought that decompression surgery is not an essential for the massive ICH patient if their haematoma removed enough.
**O-051**

**Early prediction of neurological outcome after barbiturate coma therapy in brain tumor surgery**

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**Background:** A rapidly increasing intracranial pressure (ICP) is a dangerous situation that can occur after delicate brain tumor surgery. We evaluated early predictor of clinical outcomes of barbiturate coma therapy (BCT) which was performed to control refractory intracranial hypertension (RICH) after brain tumor surgery.

**Methods:** Seventy-three adult patients who underwent BCT after brain tumor surgery between January 2010 and December 2016 were included. The primary outcome of the study was neurological status upon hospital discharge, which was assessed with Glasgow Outcome Scale (GOS).

**Results:** Fifty-six (76.7%) among 73 patients survived to discharge. Of these 56 survivors, 25 (34.2%) showed favorable neurological outcomes (GOS of 4 and 5). Invasive ICP monitoring was performed in 60 (82.2%) patients. Among those patients, 20 had been confirmed to have refractory intracranial hypertension (RICH) before starting BCT. The ICP after BCT decreased significantly compared with pre-BCT value; the maximal ICP within 6 h after BCT decreased significantly compared with that before BCT (16.2 [11.8 - 22.8] vs. 27.0 [23.0 - 39.0], p < 0.001). ICP monitoring of all the 60 patients revealed that the maximal ICP within 6 h after BCT was significantly lower in patients with favorable neurological outcome and in survivors (p = 0.008 and p = 0.028, respectively). Early controlled ICP after BCT was associated with clinical prognosis. Uncontrolled RICH (ICP ≥ 22 mm Hg within 6 h of BCT) was an important predictor of mortality after BCT (adjusted hazard ratio 12.91, 95% confidence interval [CI] 2.788 - 59.749), and especially ICP ≥ 15 mm Hg within 6 h of BCT was associated with poor neurological outcome (adjusted odds ratio 1.17, 95% CI 1.042 - 1.312).

**Conclusions:** BCT is safe and reasonable choice as a last resort of medical treatment to control RICH in patients after brain tumor surgery. Active and timely control of RICH may be beneficial for the patients’ outcomes.

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**Key words:** Pentobarbital, Brain neoplasms, Intracranial hypertension
(SjvO2), and arteriovenous oxygen saturation difference (AVDO2) were monitored every 4 hours. Metabolic derangement was defined when lactate level was more than 2.0 mmol/l. Patients were divided according to presence of clinical deterioration. A modified Rankin Scale of 5-6 at 3 months were defined as poor outcome.

Results: Twelve patients (42.9%) showed metabolic derangement and they experienced more frequent clinical deteriorations compared to patients without metabolic derangement (n=9, 64.3% vs. n=3, 21.4%, p=0.022). Clinical deterioration was noted in 14 patients, and lactate level was significantly higher in this group (1.44±0.48 vs. 1.04±0.20mmol/l, p=0.009). Adjusting other potential variables (age, baseline stroke severity, SjvO2, and AVDO2), metabolic derangement was an independent factor for clinical deterioration (OR 6.60, 95% CI 1.23-35.44, p=0.028). Meanwhile, poor outcome group (n=12) showed no difference on lactate level, but AVDO2 were higher (29.54±5.51 vs. 24.95±5.65, p=0.041). AVDO2 remained an independent factor for poor outcome after multivariate analysis (OR 3.68, 95% CI 1.08-12.55, p=0.038).

Conclusion: This study showed that lactate was associated with clinical deterioration during neurocritical care, whereas venous desaturation contributed to long-term prognosis. Jugular bulb venous monitoring is a feasible tool in acute ischemic stroke patients in the neurocritical care unit.

Key words: ischemic stroke, jugular bulb venous monitoring, lactate

O-053
The Effect of Manipulated Valsalva with Lumbar Elevation for Central Veins in Normal Subjects

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Dong-A University medical college of medicine

Background: Increasing the size of the central vein is needed to make more success rate and less complication for central line placement. Right side approach in central veins, Valsalva and Trendelenburg position were recommended, but those had inflexible points for us to be available. The purpose of this study was to establish more available patient position resulting in the largest central vein diameter.

Methods: Recruited subjects were placed in upper body at 60- and 30-, supine position, lower body at 30- and 60-, and a manipulated Valsalva maneuver plus lumbar elevation position (VmLE) consecutively maintaining a position for 10 minutes. Diameters of the subclavian vein (SCV) and the internal jugular vein (IJV) were assessed by using high-resolution 2D ultrasound at each position.

Results: The most suitable position on a bed for magnifying central veins was VmLE. The most maximum and minimum values of both the SCV and the IJV diameters in VmLE were significantly larger than those in the supine (SCV: Coefficient -0.633 and -0.863; p = 0.08 and 0.011, respectively) (IJV: Coefficient -1.09 and -1.15; p < 0.001 and = 0.001, respectively). The leg elevation had no effect on expanding central veins but rather caused those decreased.

Conclusion: The VmLE provided a greater and more relevant degree of central vein diameter increase without designing leg elevation in comparison to the values in the supine. The VmLE may be more useful for central line placement.

Key words: Ultrasonography, Catheterization, Central Venous, Subclavian Vein, Jugular Veins

O-054
Current status of home mechanical ventilator in Korea: National Health Insurance Service data

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Background: Despite the growing use, there are limited data on patients with chronic respiratory failure treated with home mechanical ventilation (HMV) in Asian countries.

Methods: Using the nationwide registry data from the National Health Insurance Service between August 2015 and July 2017, we investigated the prevalence of HMV use and primary diagnoses for chronic respiratory failure (i.e., HMV use) in South Korea.
Results: During the period, a total of 4,785 patients with HMV were identified (56.0 ± 23.9 years; female, 40.1%). The estimated prevalence of HMV use was 9.3 per 100,000 people and for child populations, it was 6.3 per 100,000. The most common diagnosis for chronic respiratory failure was neuromuscular diseases (NMDs; 42.0%) and lung/airway diseases (27.7%). However, the prevalence of lung/airway and cerebrovascular diseases increased with increasing age. Of all patients, 37.2% used mask ventilation and the proportion was highest for those with NMDs (54.4%) or chest wall diseases (33.4%) and lowest in those with brain diseases (< 10%). Among doctors who prescribed HMV, physicians accounted for 41.2%, followed by rehabilitation and neurology doctors.

Conclusions: The estimated prevalence of HMV use was 9.3 per 100,000 people, and for children, it was 6.3 per 100,000 in South Korea. NMDs and lung/airway diseases were the most common primary diagnosis for HMV use, and thirty-seven percent used mask ventilator.

Key words: home mechanical ventilation, prevalence, mask

Figure 1.

Figure 2.

O-056

Risk factors of mortality in patients with hypoxic hepatopathy

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Introduction: Hypoxic hepatopathy (HH) is a frequent cause of acute hepatocellular damage at the intensive care unit. Although mortality is reported to be high, there is little study about risk factors for mortality in patients with Hypoxic hepatopathy.

Methods: To evaluate the risk factors of mortality in patients with Hypoxic hepatopathy, we retrospectively analyzed the clinical characteristics of patients with hypoxic hepatopathy in two medical ICUs from January 2014 to December 2017.

Results: Among total 264 patients, 85 patients were included. The rate
of all-cause hospital mortality was 36.1%. 55.3% were males, and median age was 66.0 years. On multivariate analysis, higher total bilirubin, lower PaO2, higher APACHE II score, higher SAPS3 score, higher SOFA score, higher Child-Pugh score, and need for mechanical ventilation were independently associated with mortality.

**Conclusion:** Hypoxic hepatopathy was accompanied with high mortality. Higher total bilirubin, lower PaO2, higher APACHE II score, higher SAPS3 score, higher SOFA score, and higher Child-Pugh score, need for mechanical ventilation were all factors associated with increased mortality.

**Key words:** hypoxic hepatitis, mortality, ICU

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### O-057

**Current status of advance care planning for critically ill patients in Korea**

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**Background:** Advance care planning (ACP) can assist in making decisions about life-sustaining therapies (LST) for life-limited patients to minimize unnecessary suffering and honor patients’ preferences. This study examines how terminally ill patients’ autonomy operates during end-of-life care in Korean ICUs and seeks to identify influential factors of LST decisions.

**Method:** Participants of this study were patients who were either already admitted or likely to be admitted to the ICU, or their families. They were adults of least 19 years or older and either able to make their own decisions about medical treatments, or whose families had agreed on LST. Subsequently, data were gathered from three hospitals of academic institutions and one hospice facility between December 2015 and August 2017.

**Results:** Among the recruited subjects, 76 (6 patients, 70 families) agreed to participate in this study. Completion of physician orders for life-sustaining therapies (POLST) and decisions on each LST were primarily made by children (79%), spouses (9.1%), siblings (2.6%), and parents (1.3%). Only 6 patients (8%) participated in the creation of their POLST. There were discrepancies between completed LST decisions and actual LST that was performed. There were differences in the type of hospital in making the LST decision. Hospice facilities have older patients, and more dementia patients than academic institutions do (p<0.05). Older patients (≥ 80 years) were more likely to be admitted to hospice facilities and wanted to avoid intubation than were younger patients. Cancer patients were more likely to be admitted to academic hospitals and apply intubation and inotropics than were non-cancer patients(p<0.05). On the other hand, patients with dementia were admitted to hospitals more and their incidence of intubation and intubation significantly lower than those of patients.

**Key words:** Advance care plan, Korean ICU, Life sustaining therapy

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### O-058

**Barriers in appropriate implementation of “Hospice, Palliative Care, and Life-sustaining Treatment**

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**Background:** Advance care planning (ACP) can assist in making decisions about life-sustaining therapies (LST) for life-limited patients to minimize unnecessary suffering and honor patients’ preferences. This study identified obstacles in making appropriate decisions by patients regarding end-of-life (EOL) care in Korean ICU.

**Method:** Participants of this study were patients who were either already admitted or likely to be admitted to the ICU, or their families. Structured interviews using in-depth interviews for selected patients or patient families were completed, and subsequent data were gathered, from medical ICU between December 2013 and August 2017.

**Results:** Nine patients who participated in in-depth interviews had different responses than those who only participated in the questionnaire survey. Even though the survey showed that the opinion of the patient was the most important factor, we found that none of the family mem-
bers were aware of the patient's wish for LST in the in-depth interview. No family member had discussed death with the patient, and in some cases, even with the existence of advance directives, the families refused to reflect these in the patient's EOL care. In the survey, financial factors did not have significant impact on EOL care decisions. However, in the in-depth interview, economic factors were revealed as influential in EOL care decisions made by family members, due in part to fact that financial burdens tend to increase with longer hospitalization. In-depth interviews also revealed that LST decisions were deeply associated with not only "the quality of their patient's life" but also "the quality of family members' lives."

**Conclusion:** This study illustrated differences in survey and in-depth interviews and revealed some of the difficulties in implementing proper ACP, such as POLST, in Korean ICU. Such obstacles to honoring patients' autonomy in EOL care may be due to social and cultural factors, such as not discussing.

**Key words:** Barrier, End of life care, Advance care planning

**O-059**

The outcome of ICU patients perceived as beneficial or nonbeneficial admission by intensivists

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**Background:** Life-sustaining care without meaningful outcome can cause patients' and family members' sufferings, inappropriate distribution of medical resources, ICU staffs' frustrations and harm to other patients. It is important for intensivist to distinguish which patient could get a benefit from the ICU admission. The aim of this study was to detect outcomes of the patients who were perceived as beneficially or nonbeneficially admitted and to evaluate their prognostic factors associated with beneficial admission.

**Method:** A prospective observational study was conducted with patients admitted to the medical ICU in a tertiary referral center between Feb 2014 and Apr 2014. The demographic and clinical data of the patients and the perceptions of ICU physicians at the admission (day 1) and day 3 were collected.

**Results:** Total 210 patients were enrolled in this study. According to the perceptions of intensivists at the admission, 22 (10%) patients were perceived as nonbeneficially admitted, 166 (79%) patients as beneficially admitted and 22 (10%) as indeterminate. Serious underlying disease and its irreversibility was the most common (85%) reason for the perception as nonbeneficial admission. Patients perceived as beneficial admission were survived during 6 months only in 48%. Their prognostic factors of the 6-month mortality were the presence of liver cirrhosis (OR: 2.346, IQR: 1.077-5.111), solid tumor malignancy (OR: 3.079, IQR: 1.263-7.509) and male sex (OR: 2.346, IQR: 1.077-5.111).

**Conclusions:** Intensivists should consider the long-term survival benefit on deciding the admission and the goal of ICU care for critically ill patients. More prospective studies for what the beneficial admission are needed.

**Key words:** Nonbeneficial admission, beneficial admission, ICU prognosis

**O-060**

Caprylic acid attenuates vasodilation evoked by levocromakalim via the inhibition of endothelial NO

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Lipid emulsion is used to treat systemic toxicity of local anesthetic. The objective of this study was to compare the effect of Intralipid and Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim and to elucidate the underlying mechanism. Levocromakalim dose-response curves were generated in isolated rat aorta. The effect of nitric oxide synthase (NOS) inhibitor L-NAME on levocromakalim-induced vasodilation was investigated. The effect of Intralipid, Lipofundin MCT/LCT and caprylic acid on the vasodilation evoked by levocromakalim in isolated aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined. The effect of Lipofundin MCT/LCT on the vasodilation evoked by levocromakalim in endothelium-intact aorta was examined.
aorta. Lipofundin MCT/LCT (1 and 2%) and caprylic acid attenuated the vasodilation evoked by levcromakalim in endothelium-intact aorta, whereas Intralipid (1 and 2%) did not significantly alter the vasodilation evoked by levcromakalim. However, Lipofundin MCT/LCT (1 and 2%) had no effect on the vasodilation evoked by levcromakalim in endothelium-denuded aorta. In addition, L-NAME abolished Lipofundin MCT/LCT-mediated attenuation of vasodilation evoked by levcromakalim. Taken together, these results suggest that Lipofundin MCT/LCT and caprylic acid (medium-chain fatty acid) attenuate the vasodilation evoked by levcromakalim via the inhibition of endothelial nitric oxide-mediated KATP channel activation.

Key words: Lipid emulsion, nitric oxide, levcromakalim, KATP channel

O-061
Initial experience of extracorporeal membrane oxygenation model in the rat

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Purpose: Several CPB models in the small animals have already been introduced with various techniques. We describe a veno-venous(VV) extracorporeal circulation (ECC) model in rat allowing a sufficient blood flow with satisfactory perioperative results.

Materials and Methods: 10 rats underwent VV type ECC with perfusion cannula of 24Fr. Angiocatheter to left jugular vein and drainage cannula of neonatal feeding tube to right jugular vein. We classified these rats into two groups according to priming solution: Saline group (N=5) and Albumin group (N=5).

Results: Mean body weight was 538.7±42.4 g. Post-CPB potassium level was significantly different between 2 groups (7.6±2.5 versus 5.8±0.3, p=0.006). Three rats survived after 120minutes CPB times in albumin group.

Conclusion: Adding albumin to priming solution makes more satisfactory results in rat ECMO model. Further investigation will be needed.

Key words: Veno venous extracorporeal circulation, rats

O-062
Serial measurement of immune cells in severe trauma patients

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Objective: Immune function is very important in the severe trauma patients, but it is usually overlooked. We examined the progression of immune function in trauma patients.

Methods: From January to December 2017, we studied 21 patients who were admitted to Chonnam National University Hospital, Regional Trauma Center with chest trauma. Blood sample tests were performed on the day of admission, day1, day3, day7, and day30 of admission. Granulocyte (CD66b), helper T-cell (CD4), cytotoxic T cell (CD8), Gamma delta T cell (CD3+TCRd+), regulatory T cell (CD25+Foxp3+), B-cell (CD19), NK cell subtypes (CD56brightCD16−, CD56dimCD16+, CD56−CD16+) level were measured in the peripheral blood by flow cytometry.

Results: Mean age was 55.3±16.3 years old and male were 16 patients (76.2%), The mean ISS was 17.3±6.9, SOFA score 1.6±2.3. The CD56+CD16+ NK cell wea significantly decreased in severe trauma patients (ISS>15, N=6), compared to patients with ISS < 15 (p=0.04). and CD4/CD8 was also decreased in severe trauma patients (p<0.01). Most of the immune cells in severe trauma patients were not recovered within 1 month.

Conclusion: This study confirmed that the immune function of patients with severe trauma was not recovered within one month. Further studies are needed to confirm the association of immune function with clinical outcomes.

Key words: Flow cytometry, Trauma, Immune

O-063
Comparison of children managed in the pediatric intensive care unit versus other intensive care unit

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Background: Korean children are often treated in intensive care units (ICUs) rather than pediatric intensive care units (PICUs). However,
pediatric critical care (PCC) in ICUs other than PICUs may have an effect on patient outcome. This study aimed to compare the PCC outcomes of pediatric patients in the PICU versus other ICUs.

Methods: The participants of this study were children aged <18 years who were admitted to the ICUs as pediatric department of Seoul St. Mary's Hospital from March 2009 to June 2016. Patients with hemato-oncologic disease or those needing post-operative care were excluded. Patient records were reviewed retrospectively.

Results: Among the 429 ICU cases, 306 were PICU and 123 were other ICU patients. The age (18mo vs. 26mo; p=0.104) and sex ratio (57% vs. 54%; p=0.587) were not statistically different between PICU and other ICU patients. PICU patients (73%) were commonly admitted from another hospital compared with other ICU patients (63%, p=0.043). The pediatric index of mortality-3 score was not statistically different between the PICU and other ICU patients (-4.3 vs. -4.1, respectively; p=0.128); the ICU and hospital length of stay were 5 vs. 5 days (p=0.357) and 11 vs. 11 days (p=0.317); and ICU mortality was 4% vs. 11% (p=0.008), respectively. Respiratory and neurologic complications were 5% vs. 11% (p=0.021) and 4% vs. 2% (p=0.282), respectively. The odds of mortality was lower for PICU than for other ICUs (odds ratio, 0.39; 95% CI, 0.17-0.90), adjusted source of ICU admission and type of ICU.

Conclusions: Pediatric patients treated at PICU show lower mortality than those treated at other ICUs.

Key words: Children, pediatric intensive care unit, outcome

O-064

The Effects of the Presence of a Pediatric Intensivist Staffing on Pediatric Intensive Care Unit

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Background: We aimed to evaluate the effect of the presence of a pediatric intensivist staffing on a pediatric intensive care unit (PICU).

Methods: We divided two periods according to the presence of a pediatric intensivist staffing: Period 1, from November 2016 to January 2017, and Period 2, from February 2017 to February 2018. We retrospectively reviewed the medical records and investigated indications for admission, duration of hospitalization and mechanical ventilation, occurrence of unexpected CPR, and death.

Results: The number of patients and bed occupancy rate in period 1 and period 2 were 98 vs 104, and 89% vs 79%, respectively. Mean age at admission was 5.4 years (range: 0-17.5 years) in Period 1 and 3.7 years (range: 0-17.3 years) in Period 2, respectively. It was significantly different (P = 0.021). The number of patients with priority I indication was increased from 34 in Period 1 to 48 in Period 2 although it was not significantly different (P = 0.066). The number of patients with priority IV indication in Period 1 was 3, but not in Period 2. In comparison between Period 1 and Period 2, the frequency of three main causes for PICU admission changed from 31.3% to 47.5% cardiovascular, from 41.5% to 24.4% neurologic, from 36.4% to 35.8% pulmonary events. These were significant changes (P = 0.008). Mean length of PICU stay and apply of mechanical ventilation were decreased from 16.0 days and 11.5 days in Period 1 to 14.8 days and 9.9 days in Period 2, but there was no statistical significance (P = 0.701 and P = 0.784). In Period 2, there were 17 home ventilations and 5 CRRTs. In Period 1, two unexpected CPR occurred, but not in Period 2. The death rate was no significant difference between Periods.

Conclusion: Although the presence of a pediatric intensivist staffing in PICU did not significantly reduce the length of stay or improve the admission priority, it enabled efficient ICU operations and severely ill patient’s care.

Key words: intensive care unit, intensivist, pediatric

O-065

Outcome of ventilator weaning according to new classification in pediatric patients

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Purpose: We aim to describe the weaning process in pediatric patients receiving mechanical ventilation, defined as starting with any attempt at separation from mechanical ventilation and its prognosis.

Methods: We conducted a retrospective cohort study of patients who received mechanical ventilation from January 2015 to April 2016 at the PICU of Samsung Medical Center. We classified the patients into four groups according to the duration of weaning process: group 0 (no weaning) had never started a separation attempt, group 1 had a weaning process terminated within 24 hours after the first separation attempt, group 2 had a weaning process of more than 1 day and less than 1 week after the first separation attempt, and group 3 had a weaning process of 1 week or more after the first separation attempt. As outcome, we investigated the total duration of mechanical ventilation, duration of PICU stay, and mortality.

Results: A total of 124 patients were enrolled. Among them, 27% never started a weaning process, 43% had a short weaning process (group 1),
23% had a difficult weaning process (group 2), and 7% had a prolonged weaning process (group 3). Of the 124 patients, 25 patients (20.2%) died and all of them were included the group could not attempt to separate mechanical ventilation (group no weaning). Regardless of the duration of the weaning process, there were no deaths among those who attempted to separate mechanical ventilation.

**Conclusion:** In pediatric patients receiving mechanical ventilation, the duration of the weaning process was not significantly associated with mortality.

**Key words:**
BAEKDU (13:00～14:00), 5F

- Poster01 (P-001～P-008)
- Poster02 (P-009～P-016)
- Poster03 (P-017～P-024)
- Poster04 (P-025～P-032)
- Poster05 (P-033～P-040)
- Poster06 (P-041～P-048)
- Poster07 (P-049～P-056)
- Poster08 (P-057～P-065)
- Poster09 (P-066～P-074)
- Poster10 (P-075～P-082)
- Poster11 (P-083～P-091)
- Poster12 (P-092～P-100)
- Poster13 (P-101～P-109)
**P–001**

**Deterioration of Glycocalyx on cerebral and glomerular blood vessel in a rat model of pre-eclampsia**

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**Introduction:** It is well recognized that pre-eclampsia (PE) is a major contributor to maternal and fetal mortality. Although the pathophysiology of cerebral edema in PE remains unclear, increased permeability of blood brain barrier might play a major role in this pathophysiology. Recently, it reported that the structure named glycocalyx (GCX) on endothelial cells, which is involved in the maintenance of the vascular permeability barrier. In the present study, we investigated whether the degradation of GCX of cerebrum and glomerulus occurs in the PE rat model.

**Methods:** 20 rats were randomly divided into two groups: Control group (C-group, n=10); PE group (n=10). To establish experimental PE rats, a modified Sakawi’s method using administration of L-NAME and LPS was employed in the PE-group. A catheter inserted for the perfusion fixation on the day 21. After the fixation using lanthanum, the both kidney and cerebrum were removed. The image of GCX was archived from 5 to 12 cites on each tissue and determined by histogram from the image of electro-microscope.

**Results:** Significant increases in the mean arterial blood pressure, urinary protein, VEGFR-1 values, and fetal death rate were observed in PE-group compared with C-group, while maternal body weight and kidney weight were substantially lower. While the degradation of GCX in PE-group was significantly higher than that of C in both tissue (Cerebrum; C: 117 ± 24, P: 48 ± 6, p<0.05, glomerulus; C: 125 ± 30, P: 72 ± 10, p<0.01, individually).

**Conclusion:** This is the first report which the deterioration of GCX layer in endothelium occurs on the cerebrum and glomerulus as well as other organ already reported in other illness. Alterations of this structure may compromise endothelial permeability with associated interstitial fluid shift and generalized edema. The degradation of GCX might be involved in cerebral impairment and proteinuria in PE-patients.

**Key words:** Glycocalyx, Preeclampsia, vascular permeability

**P–002**

**The Effect of N–acetylcysteine on Multidrug Resistant Acinetobacter baumannii Infection in vitro**

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**Background:** Multidrug resistant Acinetobacter baumannii infection is challenging in clinical practice, and the embarrassing situation is lack of drugs which can be used for the treatment. N-acetylcysteine (NAC) exists the synergistic effect against different Gram-negative pathogens. However, whether it possesses the same effect on MDR-Ab is unknown. Therefore, the aim of the paper is to address the potential ability of N-acetylcysteine in the treatment of MDR-Ab infection.

**Methods:** The MDR-Ab strain was isolated from a patient with VAP and resistant to imipenem, cefoperazone and moxifloxacin, but sensitive to polymyxin B and tigecycline. The bacteria (10 cfu) were used to infect the macrophages with different concentration of NAC in culture medium and the remaining survival bacteria were quantified by serial dilution on LB agar plates. The level of cytokines secreted infected macrophages were measured with ELISA. The combination effect of the NAC and other antibiotics were determined by FIC index.

**Results:** After 2 hours co-inoculation with macrophages, the survival bacteria decreased significantly in all the NAC groups (Figure 1), and the phagocytosis ability is proportional to the concentration of NAC. The level of proinflammatory cytokines did not show any statistical significance at 2 hours, and 72 hours, but the cytokines in the group with NAC were significantly lower at 12 hours, 24 hours and 48 hours (p < 0.05). The FIC index indicated that NAC had the synergistic effect when together used with the common antibiotics (imipenem/ Cilastatin, cefoperazone/sulbactam, polymyxin B and tigecycline), but showed no-interaction with amikacin and moxifloxacin.

**Conclusion:** N-acetylcysteine exhibits the potential anti-Acinetobacter baumannii ability and possesses the synergistic effect of some of the common using antibiotics, and can reduce inflammation level in vitro. However, whether NAC exists the equivalent function in vivo should be further studied.

**Key words:** N-acetylcysteine, Acinetobacter baumannii
**P-003**

Clinical guideline: Prevention and Management of Pressure Injury in Elderly Patients

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**Background:** Pressure injury (pressure ulcer) is a very common medical care problem for elderly hospitalized patients. Between 3% and 10% of hospitalized patients can experience, causing patient’s pain, infection and prolonged stay in hospital. As our hospital result, the medical cost is increased and the number of nursing hours is increased by 50%, the average length of stay of hospitalized patients was 13.6 days, while the number of days of hospitalization for pressure injury patients was as high as 40.6 days, seriously affecting the utilization of medical resources.

**Methods:** Systematic review of relevant literature based on the theoretical basis of empirical medicine, use of PICO to search CINAHL, Medline, Pubmed, Cochrane Library, JBI, TRIP and Airiti Library Databases, and selected the study types as Clinical Guideline, Systematic review, Meta-analysis and Randomized controlled trial. The literature review used the Critical Appraisal Skills Program Checklist and conducted empirical rankings according to the Oxford Center for Evidence-Based Medicine 2011 Levels of Evidence.

**Results:** A total of 18 articles were selected according to the assessment of reading comprehension. The guide steps and levels of evidence were sorted out to assess the risk factors of in-patients with pressure injury. Based on the assessment results and objectives, cases, family members and carers were selected to establish individualized care plans. Nutritional assessment and nutritional support to provide suitable care based on skin condition and existing wounds, structured care guidance on major caregivers and individual cases, continuous shift and treatment at transfer or discharge, continuous monitoring of the quality of pressure injuries standard.

**Conclusion:** This systematic review study literature review and compiled suitable guidelines for the care of local hospitals, and summarized the clinical application of evaluation, planning, prevention and treatment measures.

**Key words:** elderly patient, pressure injury prevention, pressure injury treatment

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**P-004**

THE IMPACT OF ANTI-INFLAMMATORY AND IMMUNOMODULATORY OF BILIRUBIN ON THE ANIMAL MODEL WITH SEPSIS

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**Background:** Bilirubin is the product of heme catabolism pathway, was excreted in bile and removed from the body through urine. Bilirubin has not only a potent antioxidant but also role anti-inflammatory, protect the body against endotoxin-induced lung inflammatory, down-regulate expression of adhesion molecules, inhibit infiltration of inflammatory cells, specific is neutrophils in the inflammatory response. Thus, Bilirubin is one of the candidates for protecting the body against severe sepsis-induced tissue injury.

**Method:** in this study, we used lipopolysaccharide to induced endotoxemia, and 24 h later, mice underwent cecal ligation and puncture to induced sub-acute. Next, to investigate the anti-inflammatory capacity of bilirubin, we measured the pro- and anti-inflammatory cytokine expression in lung, liver, and kidney by ELISA. Then, to clarify the immunomodulatory effect of bilirubin, we investigated the number of immune cells (neutrophils, macrophages, T cells and myeloid-derived suppressor cells) recruitment in blood by flow cytometry. Further, the function of T cells and apoptosis of neutrophils also were determined.

**Results and conclusions:** We observed that bilirubin inhibited the pro-inflammatory cytokines expression, while the levels of anti-inflammatory cytokines were significantly accelerated in lung, liver, and kidney. Bilirubin improved the survival rate on severe sepsis model. Further, we suggested that bilirubin can modulatory the accumulation of...
macrophages, myeloid-derived suppressor cells. Notably, bilirubin suppressed the activation and functions of T cells and promoted neutrophils underwent apoptosis. These results clarified that the beneficial of bilirubin may improve tissue injury in severe sepsis through the anti-inflammatory and immunomodulatory mechanism.

**Key words:** Bilirubin, sepsis, anti-inflammatory, immunomodulatory

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**P-005**

*The therapeutic strategy for incarcerated obturator hernia after reduction under ultrasonography*

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Obturator hernia is a relatively rare pelvic hernia which can cause bowel obstruction and usually occurs in elderly women. Despite improved imaging techniques which can allow us to make a preoperative diagnosis, emergent operation is still often carried out. It is very risky because the patients are elder. We need preoperative examinations to their general conditions (respiratory function, cardiac function and so on.) for safe operation. We suggest the strategy based on reduction under ultrasonography for avoiding emergent operation. It leads safe elective operation.

At first, we examine intestinal perforation by Computed Tomography (CT). When we suspect intestinal perforation, we consider emergent operation. When we don't find perforation and just incarceration, we try to reduce under ultrasonography. If we can't reduce, we consider emergent operation. We have been able to reduce all five cases until now. It took 3.8 sec as mean time. After reduction, they are admitted to hospital conservatively. In the hospital, we pay attention to delayed intestinal perforation and examine their general conditions. According to their conditions, we can safely choose the anesthetic method (local or general) and operative method (laparotomy or laparoscopy).

We present the concrete cases and explain the strategy (Fig.1.).

**Key words:** obturator hernia, reduction, ultrasonography

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**P-006**

*Guidewire Embolism in ECMO: A Potentially Hazardous Complication during Central Line Placement*

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**Introduction:** Central venous catheter (CVC) plays an important role in the management of critically ill patients. Although few cases have been reported, CVC insertion in the patients on extracorporeal membrane oxygenation (ECMO) can lead to life threatening complications. We present a case of guidewire embolism in ECMO circuit.

**Case presentation:** A 60-year-old man, who presented with sudden cardiac arrest, was successfully resuscitated using veno - arterial ECMO. During an attempt to place a CVC through the right jugular vein, the guidewire was sucked into the vein. Fortunately, the guidewire was entrapped in the venous cannula, and ECMO continued to operate normally. The patient was uneventfully weaned from ECMO on the next day, and the guidewire was retrieved from the cannula. Although there was no actual harm or additional cost, the event can lead to catastrophic complications.

**Conclusion:** CVC placement in patients on ECMO can lead to guidewire embolism in the ECMO circuit.

**Key words:**

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**P-007**

*Results of the Arterial Blood Gas, Acid–Base Balance in Patients with Acute Stroke*

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**Background:** Acute stroke (AS) is one of the leading causes of morbidity and mortality in Mongolia. The number of the patients with AS is high in the neurological emergency and intensive care cases. Arterial blood gas (ABG) and Acid–Base Balance (ABB) is indicators of the homeostasis of the human organism and these indicators would be impaired in every one tenth of the patients in the Emergency and Intensive Care Units. Researchers from various countries had shown that in patients with AS, ABG and ABB is impaired in tendency of respiratory alkalosis and metabolic acidosis-respiratory alkalosis. Number of studies had been conducted and published on the arterial and venous blood gas and ABB
by Mongolian researchers. But there are no studies had been shown the level of the impairment of ABG and ABB of the patients with AS. Our study results will indicate the level of the ABG and ABB of the patients with AS and will provide with the evidence to improve clinical guidelines and protocols for avoiding complications and improving the survival rate.

**Objective:** The change in the level of ABG and ABB parameters of the patients during AS and its relation to various conscious state and outcome of the patients.

**Materials and methods:** We designed this study as an epidemiological descriptive case study. 190 patients, in age from 35 to 74, from Emergency and ICU, department of neurology of the State central hospital no. 3, and the patients from ICU and department of neurology from the State central hospital no. 1 were included in our study. 45 patients were excluded from the study and 91 males and 54 females from the total of the 145 patients were selected for the study. Patients were selected by categorized selection method. For the study parameters the patient ABG and ABB, the indicator of the severity and mortality prediction, APACHE II score, and indicator of the unconsciousness, the Glasgow Scal

**Key words:** Stroke, Blood gas

**P-008**

**A study on the commonest life-threatening diseases and the capabilities of medical care in rural (soum) primary hospitals**

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**Background:** It is possible to save lives of whom acute ill or injured young adults by emergency and intensive care service, that known as chain of critical care, and the possibility to reduce preventable death is higher in low and middle-income countries. Therefore this study has been conducted to solve problems facing to doctors in Soum, Inter-soum (rural) hospitals, organize a training and revise the list of necessary medical equipment, consumables and medicines.

**Aim:** To study the commonest diseases prevalence and the capability and capacity of rural Soum hospitals.

**Materials and Methods:** The multicenter prospective cohort method was used for 6 months. 74 Soum hospitals from 9 provinces participated. The randomized cluster sampling was used. The Ethic approval from Mongolian National University of Medical Science was obtained.

**Results:** In emergency (room) care, only 10(13.5%) hospitals are possible to manage the airway and 6(8.1%) able to perform thoracentesis. Overall 1267 cases registered in hospital emergency area and the average age was 34(18-53). The common incidences in emergency care services by disease category were trauma 325(25.7%), acute non-traumatic surgical diseases 245(19.3%). The modified early warning score is 3(2-5) and trauma score is 1(1-2). In-hospital mortality is 41(3.2%). The leading causes of admission of emergency care services were non-brain trauma 258(20.4%), acute abdomen 214(16.9%), acute or chronic heart failure 122(9.6%) and brain trauma 67(5.3).

**Conclusion:** The commonest diseases are trauma, acute abdomen and heart failure within patients in emergency departments. The capability of critical and trauma care in soum/inter-soum hospitals is limited due to human resource and medical supplies.

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**Key words:** Emergency care, life-threatening disease, modified early warning score

**P-009**

**Adaptations to mass casualties in the nearest hospital after the Formosa Fun Coast Dust Explosion**

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**Background:** The Formosa Fun Coast Dust Explosion (FFCDE) caused 499 victims, average age of 23, were delivered to 34 hospitals.1 The study examines how the nearest hospital dealt with the influx of burn patients to reveal the difficulties that challenged the hospital, and how they adapted to keep pace with the potential for overload in the emergency department (ED) as the mass burn casualty incident (MBCI) developed over time.

**Methods:** Data was gathered by in-depth interviews with 15 key participants using open-ended questions. The interview data was combined with medical records of the FFCDE patients and admission logs to
build a detailed timeline of ED workload. Process tracing analysis was applied to explore how the hospital adapted to cope with the potential bottlenecks created by the MCBI.

**Results:** 59 burn patients were treated over a period of 6 hours while the ED also managed 43 non-FFCDE patients. 44 patients with average total body surface area burn 51.3% were admitted. 20 patients were intubated. The overwhelming demand created five major difficult situations: lack of nurses, all treatment spaces were filled, run out of stretchers, lack of critical medical materials for burn care. 16 key functional adaptive activities for victims' resuscitation and life support are identified and synthesized into three typical adaptive strategies: “Borrow” some of patients’ resilience to provide additional buffering capacity; “scarify” some lower level goals to satisfy higher one; an anticipatory attempt to use highly irregular resources to extend the treatment area. The analysis revealed the hospital’s ability to adapt under uncertainty was based on anticipating potential bottlenecks ahead and dynamically reconfiguring coordination across roles and units.

**Conclusion:** The MCBI created a chaotic environment in the ED. This findings identify lessons to improve disaster planning and preparation for future mass casualty situations.

**Key words:** Formosa Fun Coast Fire, system resilience, resilience engineering, burn patients, Emergency Department

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**P-010**

A case with falsely elevated thyroid hormone levels

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**INTRODUCTION:** Immunoassays including thyroid hormone measurement have some limitations associated with endogenous antibody interference and erroneous results may lead to unnecessary examinations and inappropriate treatment.

**CASE PRESENTATION:** The patient is an 82 year-old female receiving warfarin following aortic valve replacement for more than 20 years. At the routine clinic visit, her thyroid function test measured by electrochemiluminescence immunoassay (ECLIA) showed increased levels of free T4 (FT4) and free T3 (FT3) and normal thyrotropin (TSH) level. No interventions were taken since symptoms of hyperthyroidism were absent. Two months later, she was admitted to a community hospital complaining dyspnea and tachyarrhythmia on exertion. Atrial fibrillation was noted for the first time and thyroid function test using the same method showed the similar results on admission. High fever was observed two days after admission. She was diagnosed as exacerbation of heart failure due to infection and hyperthyroidism. Beta-blocker, diuretics and propylthiouracil were administered. Although the origin of the fever was not determined, antimicrobial therapy was also undertaken with a tentative diagnosis of prosthetic valve endocarditis. After discharge, propylthiouracil was discontinued and thyroid function was again tested. Measurement using alternative method showed euthyroid state. Further study suggested substance of a molecular weight equal to that of IgM might have interfered with ECLIA and contributed to falsely elevated thyroid hormone levels.

**CONCLUSIONS:** Clinicians must bear in mind possibilities of interference in any immunoassay. And when obtained results of FT4, FT3 and TSH do not fit the patient clinical presentation, retesting with alternative method should be considered.

**Key words:** immunoassay, thyroid, interference

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**P-011**

Do-Not-Resuscitate Orders Affects the Outcome in Septic Patients

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**Background:** As population ageing, “Do-not-resuscitate” (DNR) orders appears more common in patients’ medical decision making. Sepsis patients requires timely and appropriate treatments in intensive care. However, DNR status may have a reduced priority of intensive care and affect the physicians’ treatment modalities in dealing with patients. The main purpose of our study was to assess the effect of presence of a DNR status among septic patients.

**Methods:** This was a retrospective cohort study conducted in emergency department intensive care units (ED-ICU) in university-based teaching hospital. Patients diagnosed with sepsis admitted to our ED-ICU were included between April, 2015 and November 2015. We compare the...
baseline characteristics, APACHE II score, SOFA score and DNR status in predicting in-hospital mortality. Receiver-operating characteristic (ROC) curves were also used to assess the predictions.

**Results:** In eight months, 132 patients were identified in the study, 49.2% (65/132) of them had DNR status. Median age was 80 (38-103), median ICU length of stay was 4 days and total hospital LOS was 15 days. Overall in-hospital mortality was 28.8% (38/132). There was no significant difference in gender, body mass index, and primary sites of infection. Higher Charlson Comorbidity index (7.3(6-9) vs. 8.5(7-12.3), p=0.012), higher APACHE II (20(16.75-25) vs. 25 (20-30.25), p=0.002), and higher SOFA score (6(4-8) vs.7 (6-11), p=0.012) were significant predictor of mortality. Multivariate analysis showed that the presence of DNR orders was independently associated with mortality (odds ratio: 7.043, 95% CI= [2.552-19.436], p<0.001). ROC area under the curve (AUC) of DNR status combined with scoring systems was 0.81 0.814 95% CI= [0.73-0.90], p<0.001, suggesting good discriminative powers for predicting in-hospital mortality.

**Conclusion:** After adjusting for comorbidities and illness severity, septic patients with DNR status remained a significant impact on mortality purpose, objectives and interventions.

**Results:** There were five original papers (0 intervention studies, 5 research studies) identified that reported on the specific terminal care provided for families. All the studies content analyzed nurses’ terminal care practices for families. Practice of terminal care for families was based on the core competencies described in the Guidelines: “rights advocacy”, “palliative care”, “maintaining a trusting relationship”, “information provision”, “families participate in care”. In addition the five core competency elements of “maintaining of family system” were extracted.

**Conclusion:** The actual terminal care provided by nurses for families in the intensive care area was carried out with a focus on the core competencies of the “Psychological Care Guidelines” composed of family nursing care and grief care. Providing all aspects of support for family members of patients at the EOL are considered to be a core competencies in the Psychological Care Guideline.

**Key words:** end of life care, Intensive care, family care

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P-012

Nurses’ end of life care for families in the intensive care area in Japan: A review of literatures

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**Background:** Unexpected and sudden death in the intensive care area requires nursing care for the remaining family. In 2011, to bolster the support systems for families in Japan the Japanese Society of Intensive Care Medicine task force developed, “The Psychological Care Guidelines for Family Members of Terminally Ill Patients in the Intensive Care Area”. In this research, we aimed to clarify the actual situation of end of life (EOL) care for families performed by nurses in the intensive care area of our country through literature review.

**Methods:** We conducted a domestic literature search using the medical center magazine WEB version (Ver. 5) beginning in 2008 and ending Feb 16, 2018. The keywords were “critical care”, “intensive care”, “EOL”, “terminal care”, and excluding critical care areas and intensive care areas. After that, a researcher prepared review sheet was used to collect the data from each article. Data were classified according to the similarity of the research contents, and summarized based on the research

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**Key words:** Do-not-resuscitate, sepsis

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P-013

Left atrial Dysfunction in Stress induced Cardiomyopathy: More than Ventricular Dysfunction

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**Background:** The clinical presentation of stress induced Cardiomyopathy (SIC) mimics that of acute myocardial infarction (AMI). In addition, right ventricular involvement is known to be more frequent in patients with SIC than those with AMI. However, it is little known about left atrial (LA) function in SIC.

**Methods:** We prospectively enrolled patients with newly diagnosed SIC and AMI. Echocardiographic studies were performed on hospital day 1 or within 24 hours of primary percutaneous coronary intervention. Peak global LA longitudinal strain (PLAS), strain during late diastole (LAS-a) and peak global left ventricular (LV) longitudinal strain (GLS) were measured in all subjects by averaging all LA and LV segments, respectively. Follow up echocardiography was performed in 6 weeks later.

**Results:** Ten patients with SIC and 20 patients with AMI (74±10 vs 58±14 years; P=0.02) were enrolled in the study. The LVEF was similar in two groups (P=0.82). Right ventricular involvement was more frequent in SIC patients than in AMI patients (5/10 vs 1/20, P=0.009). LVGLS was similar between two group (-10.1±3.0 vs -9.9±3.0%, P=0.91). No difference of LA volume was found (30.7±6.6 vs 31.7±6.9 mL/m2, P=0.69), however, PLAS was significantly lower in SIC patients than AMI patients (12.0±4.0 vs 20±4.9%, P=0.001).
PLAS was related to LVGLS in all patients ($r=0.446$, $P=0.029$), however, this relationship was not maintained in SIC patients only ($r=0.386$, $P=0.167$). LAS-a was also significantly lower in SIC patients than AMI patients (6.4±2.3 vs 11.2±3.7%, $P=0.004$). PLAS was similarly improved in both all SIC patients and 12 AMI patients who showed recovered regional wall motion abnormalities (24.5±5.2 vs 25.5±5.0%, $P=0.34$).

**Conclusion:** LA function was more impaired in SIC patients than in AMI patients even LV function was similar in two groups. Both LV and LA function were recovered in SIC patients, which may mean not only ventricular but also atrial transient dysfunction.

**Key words:** Left atrial Dysfunction, Stress induced Cardiomyopathy

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**P-014**

**CABG In Patient With Severe Kyphoscoliosis : A Rarity Of A Condition**

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**Introduction:** Kyphoscoliosis causes restrictive lung disease, ventilation-perfusion mismatch, hypoxemia and cardiovascular involvement in various forms. Thus careful preoperative optimization and postoperatively, intensive respiratory therapy and pain management are prime concerns.

**Case Report:** 68-year-old male with known case of triple vessel disease, hypertension, myocardial infarction, severe kyphoscoliosis and severe restrictive lung disease. In OR, lungs were preoxygenated, there were no issues during intubation and maintaining ventilation in our case. When the chest was opened, the heart and aorta were seen to be shifted and rotated towards the right thorax. Saphenous Vein graft was harvested to reach the LAD. Eighteen hours after surgery, with hemodynamic stability, trachea was extubated using standard weaning protocol with backup of NIV weaning strategy. Patient controlled analgesia, targeted incentive spirometry, effective coughing, chest expansion, ambulation and functional independency of daily activities were done in the consecutive days and discharged home on the 7th postoperative day.

**Discussion:** Major operation of kyphoscoliotic patients have multiple technical challenges. In our case, we managed expected difficulties by keeping difficult intubation trolley, inotropes loaded, CPB pumped primed and all ready to use before induction of anesthesia. Use of lung protective and noninvasive ventilation after extubation, vigorous chest physiotherapy with incentive spirometry, aggressive pulmonary toileting and early ambulation were done to reduce the postoperative respiratory morbidity. This case also highlights the paramount importance of partial or complete independence to perform daily and instrumental activities associated with decreased risk of postoperative pulmonary complication.

**Key words:** Kyphoscoliosis, CABG, postoperative pulmonary complication

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**P-015**

**The Comparison of Outcome among Surgical and Medical Patients Experienced Unplanned Extubation**

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**Objectives:** This study compared the prognostic factors and outcomes of unplanned extubation (UE) among medical and surgical patients in a medical center’s 6 intensive care units (ICUs) and calculated their mortality risk.

**Methods:** We retrospectively reviewed the electrical medical records (EMR) of all adult patients in Chi Mei Medical Center who underwent UE between Jan 1, 2009 and July 31, 2017.

**Results:** During the study period, there were 341 ICU patients experienced UE, and 161 patients were in surgical group (47.2%). There were
112 female patients (32.8%), and the mean age was 65.1 years (range: 18-101 years). The mean Acute Physiology and Chronic Health Evaluation (APACHE) II score was 16.8 and mean Glasgow coma scale score was 10.1. One hundred thirty-seven patients (49.0%) were reintubated within 48 h, and sixty patients died (17.6%). Compared with medical group, the surgical patients had a similar mean value of ICU (14.3 vs. 15.7 days), hospital stays (37.8 vs. 37.5 days) and hospital costs (51.7 vs. 46.3 X 10000 New Taiwan Dollars), but lower hospital mortality (13.0% vs. 21.7%, p=0.025). Multivariate analyses showed 3 risk factors—uremia, liver cirrhosis, and cancer patients—were independently associated with mortality.

**Conclusions:** Among UE patients, surgical group had similar hospital stays and expenditures. After adjusting for confounding factors, surgical patients were not associated with hospital mortality. Uremia, liver cirrhosis, and cancer patients—were associated with high mortality in patients who underwent UE.

**Key words:** unplanned extubation, mechanical ventilation, intensive care unit

**P−016**

The patient with SMA syndrome after surgery complicated with pneumonia re-admitted to ICU

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**Abstract:** Good communication between nurses and patients is essential for the successful outcome of individualized nursing care of each patient. This article describes the nursing experience of a patient with superior mesenteric artery (SMA) syndrome after surgery, complicated with pneumonia, and returned to intensive care unit.

**Tools:** During the nursing period from September 14 to 23 in 2017, we evaluated the patient using Gordon 11 Function Health Patterns through direct meetings, conversations, observation, physical assessment, and medical records for comprehensive health assessments.

**Case presentation:** The 83 years old women was admitted under the diagnosis with SMA syndrome. Operation with gastrojejunostomy and jejunostomy was done on the admission day. Postoperative day (POD) 2, she was transferred to ward with stable clinical condition. Unfortunately, she was transferred back to ICU on POD 7 because of pneumonia. After evaluation tool, the patient had complicated health problems, including ineffective airway clearance, wound pain, and anxiety. With above problems, we communicate with team members. The team members including family members, physicians, nutritionists, physiotherapist, social workers and psychologists. Based on patient’s clinical condition and treatment plans, we provide individuality and holistic nursing intervention to assist the case to ease the body and psychological discomfort. After all health issues are eased and further care plans are provided, she will be transferred to ordinary wards.

**Conclusion:** Nurses are first-line service providers who take care of patients directly and are the largest members of the medical team. Effective communication is central to the provision of compassionate, high-quality nursing care. Hopefully, this nursing experience can serve as a reference for the care of such patients.

**Key words:** superior mesenteric artery syndrome, pneumonia, nursing experience

**P−017**

A study on disease prevalence and mortality rate in intensive care units in tertiary care hospitals in Mongolia

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**Introduction:** Some researchers have found that the hospital mortality rate in low and middle income countries is higher than that in high income countries and it is possible to reduce the mortality rate by improving the emergency and intensive care service. The study aim was to process mortality reduction management and progress the intensive care service. For that reason, it is important to study to determine the disease prevalence and mortality rate in intensive care units of tertiary level hospitals.

**Methods:** We used prospective cohort study.

**Results:** During 6 months of study period, 1107 patients were admitted to ICUs of 8 hospitals. The patients, admitted to ICU of National Trauma and Orthopedic Research Center (NTORC), had an average early warning score (EWS) 6 (4-7) and mostly required emergency surgery. EWS of other hospitals were lower than NTORC 5(3-7) in the Central hospitals of Ulaanbaatar and then 3 (2-5) in Regional Diagnostic and Therapeutic Centers (p<0.001). The hospital length of ICU bed was the least in NTORC 2 (1-5), whereas the most in NCMCH 4 (3-6), and in Tertiary care hospitals of Ulaanbaatar were 3 (1-5) days. (p=0.001). The mortality rates were significantly different among the hospitals, for instance ICU of NTORC -73(40.6) , ICU of Central hospitals of Ulaanbaatar were 158(29.8) and ICUs of Regional Diagnostic and Therapeutic Centers were 158(17.8) respectively. The leading cause of ICU admission in NTORC was brain injury 57.2% and others trauma 40%, whereas brain stroke 24.9% and sepsis 19.4% in Central hospitals of Ulaanbaatar . The common incidences in ICUs of Regional Diagnostic and Therapeutic Centers were brain stroke 21(13.8) , acute
and chronic renal failure 17(11.2), and brain injury 16(10.5).

**Conclusion:** In ICUs of tertiary level hospitals, incidences of brain stroke and sepsis were most common, whereas brain injury was common in ICUs of NTORS and Regional Diagnostic and Therapeutic Centers. There was a difference in the mortality rates between hospitals. Overall, it was 2-3 fold higher than that in high income countries.

**Key words:** Diseases prevalence, mortality rate, intensive care.

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**P–018**

**The critical care sufficiency and diseases prevalence at the secondary level hospital in Mongolia**

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**Introduction:** The hospital mortality rate in low and middle-income countries is much higher than developed countries, thus enhancing the critical and emergency services will reduce rate of mortality. Providing life saving treatment, continuous monitoring for the critically ill patient survival is definitely linked to availability and capability of equipment, drugs, medicine and trained personnel. Therefore, the challenges are determined and introduce stepwise method to reduce in-hospital mortality.

**Aim:** Determining second level hospital's capability to provide critical care and sufficiency of medical supply and to study diseases prevalence in the intensive care unit.

**Materials and Method:** Provinces and district hospitals were included in the research and cross-sectional study conducted. The second level hospitals were selected from 9 provinces hospitals in 4 regions of Mongolia, 5 district hospitals in the capital city of Ulaanbaatar were involved, clustering and randomised in research. The research conducted after obtaining Medical Ethical Committee approval.

**Result:** None of the hospital is able to provide with 24-specialist doctor service. In the emergency settings, capability for FAST ultrasound examination is 8 (57, 1%) hospitals, and none of the hospital is able to provide echocardiography. Even though the number of intensive care bed is 5.6, the number of ventilators of hospitals are 2.5 ventilators in 100.000 populations. 1 hospital is equipped with air-oxygen system. In 3 hospitals (21.4%) are always able to perform central venous catheterization, and only 3 of the hospitals (21.4%) capable with non-invasive ventilation. Drug and medicine use for cardiopulmonary resuscitation, available of atropine and amiodaran were 9 (64.3%) and 5 (35.7%), respectively.

During 6 month of study period, 454 patients were admitted to the district hospitals, whereas 470 Reference:


**Key words:** Critical care, equipment, human resource

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**P–019**

**Experience of taking care of Anti–NMDA receptor encephalitis by using SWANSON**

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This article is mainly for an experience of take care an Anti-NMDA receptor encephalitis case. Anti-NMDA receptor encephalitis is a new uncommon self-immunoreaction abnormal disease, which clinical practices are less. In this treatment process, patient not only needs to confront sudden link weakness, also need to confront the different of self-care in the long convalescence. In intensive care ward, writer gather information by listen, communicate, observed, and check the medical case of illness. According to physical, psychological, social, spirituality these four level comply holistic nursing assessment, establish the nursing problem in this case is : 1. Risk for aspiration / can’t swallow. 2. : Mobility impaired physical / poor limb endurance. 3. Powerlessness / can’t control the change of physical function. By using SWANSON for nursing measures and used empathy to take nursing care, evaluate the level of understanding of disease which patient know, analyze patients’ demand, provide information and approach initiative face the disease with a positive attitude to promote the patient’s self-decision of motivation with cross team work, let patient have a complete and sustained holistic care. By using cross team work cooperation to help patient get well disease adaptation and build confidence to reduce the life dysfunction caused by disease to get back to usual life is the most worthy of this process. Because of the limit on acute medical care in the guest time at intensive care ward, it’s difficult to explore in depth the effect of family act aberrant. It’s a little pity can’t let members’ interactive into the overall rehabilitation health education program. This disease compare with the general emergency, from diagnosis to recovery, it’s much more complicated and take more time. In this case, good care and support by main caregiver is the most important thing.

**Key words:** Anti-NMDA, SWANSON
P-020
The Outcome of Patients with Readmission to Subacute Respiratory Care Center

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Introduction: The long-term use of mechanical ventilator (MV) will increase the burden of medical resources. Some patients have been repeatedly admission to Subacute Respiratory Care Center (SRCC) clinically. Those who were re-admitted to SRCC might have a worse outcome. This study was to disclose the final prognosis and predicted factors of patients with re-admission to SRCC.

Methods: This was a retrospective, observational study enrolled patients from January 1, 2007 to December 31, 2017. The inclusion criteria was patients older than 60y/o admitted to intensive care units (ICUs) and later transferred to SRCC survied by chest mams. The following data were collected: age, gender, Acute Physiology and Chronic Health Evaluation (APACHE II) score, BUN, Creatinine, albumin, phosphate, Hemoglobin, hemodialysis with renal replacement therapy (RRT), mortality rate and transferal to Chronic Respiratory Care Ward (CRCW). The SPSS for windows 17.0 was used to analyze the patient’s data. Indenpeding T test and Chi-square were used to compare the outcome and factors associated with re-admission to SRCC.

Results: We enrolled 1666 patients in study. The age, gender, BUN, creatinine, phosphate, Hemoglobin and RRT were found to be unrelated to re-admission to SRCC. Besides, those who were re-admission had a relatively lower mortality rate (14.3% vs 16.4%, p=0.6160). But those who were re-admission had a higher ICU origin (83.8% vs 63.4%, P<0.05), a higher ICU APACHE II score (22.7 ± 6.3 vs 20.7 ± 7.6, p<0.05) and SRCC APACHE II scores (18.4 ± 5.6 vs 16.9 ± 6.1, p<0.05), a lower rate of MV weaning (48.4% vs 59.2%, p<0.05) and higher rate of ventilator dependence with transferal to CRCW (37.3% vs 24.4%, p<0.05) as compared to who were not.

Conclusion: The patients with re-admission to SRCC had a lower rate of MV weaning. Although this re-admission did not affect the hospital mortality, the rate of long-term MV dependence with transferal to CRCW was higher.

Key words: Subacute Respiratory Care Center, re-admission, mechanical ventilator weaning, hospital mortality

P-021
Tracheostomy In Hospital Mortality for Patients with Head Injury after from Mechanical Ventilator

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Introduction: The patients with head injury usually develop respiratory failure under mechanical ventilator support. This research was to evaluate the impact of tracheostomy on the in hospital mortality for these patients after liberation from mechanical ventilator.

Methods: A retrospective cohort study was designed for this research. The clinical data of of subacute respiratory care center (RCC) of Chimei Medical Center, Taiwan was evaluated from January, 2012 to October, 2017. The data of age (18 to 70 years old), gender, Acute Physiology and Chronic Health Evaluation (APACHE II) score, blood urea nitrogen (BUN) (mg/dL), creatinine (mg/dL), albumin (mg/dL), phosphate (mg/dL), hemodialysis, tracheotomy performance or not, and in hospital mortality were evaluated for this study. The SPSS for windows 17.0 was used to analyze the patient’s data. Indenping T test and Chi-square were used to analyze the mortality outcome of these patients after liberation from mechanical ventilator for the two cohorts (tracheotomy performance or not), the significant different was indicated with P-value < 0.05.

Results: A total of 212 cases were enrolled in this study, included tracheostomy cohort (N=90) and without tracheostomy cohort (N=111). Clinical data of these patients' age, gender, and blood biochemical tests (BUN, creatinine, albumin, phosphate levels) showed no significant different between the two cohorts. The clinical in hospital mortality in tracheostomy cohort is lower than the cohort without tracheostomy (mortality rate; 3.2% Vs 6.7%, P > 0.05) but without reaching significant different. High RCC APACHE II scores related with in hospital mortality rate of these patients after weaning from ventilator (12.66 ± 0.349 Vs 17.6 ± 1.127, P < 0.05).

Conclusion: Low in hospital mortality rate was found for these patients with tracheostomy after liberation from mechanical ventilator. High RCC APACHE II scores related with the in hospital mortality rate.

Key words: Head Injury, Tracheostomy, In Hospital Mortality
**P-022**

Assisting a patient of chronic heart failure with Watson’s Theory Of Human Caring Model

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**Introduction:** According to epidemiological survey all over the world, the prevalence and incidence of heart failure will increase with age: when the age becomes to 80, the prevalence will increase to 8%, and about 12% to 53% of them was with sleep apnea (Liu, Li, Xu, 2010; Lai, Yan; 2011). Usually heart acts like a pump that delivers blood throughout the body but people with heart failure will cause heart-lung, peripheral tissue insufficiency, and combine with sleep apnea syndrome, therefore they will not be active but with no endurance, sleep disorders and anxiety and other health problems, and even severe sleep apnea will be accompanied by a significant decrease in blood oxygen concentration, which affects life safety (Lai, Yan; 2011).

**Case Presentation:** The 88-year-old male patient with frequently apnea during sleeping and heart failure is suffering from health problems such as sleep-type disorder accompanied by high-risk of falling, no endurance during activity and anxiety. During the nursing period from May 2 to 12 in 2017, we evaluated the patient with Watson’s Theory of Human Caring through direct meetings, conversations, observation, physical assessment, and medical records for comprehensive health assessments.

**Conclusion:** To deal with health problems of the individual cases, we provide team-based rehabilitation activities, diet and medical treatment to increase cardiopulmonary function progressively which based on Watson’s Theory of Human Caring, besides we use listening and empathy techniques to encourage cases to speak out and give the patient clarification, counter-provision and resources assistance timely. In addition we make the patient face the disease bravely during the recovery process and boost their confidence in the prognosis with better physical and psychological self-care ability for quality of life at home. We look forward to sharing this nursing experience as a reference resource in taking care of such clients.

**Key words:** Heart failure, sleep apnea, activity intolerance, anxiety, Watson’s Theory of Human Caring

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**P-023**

Long-term Outcome of Very Elderly (≥80 years) Critical-ill Patients in Medical Intensive Care Unit

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**Background/Aims:** This study evaluated long term outcome in very elderly (≥80 years of age) critical-ill patients admitted to a medical intensive care unit (MICU) in a regional single tertiary hospital.

**Methods:** We retrospectively analyzed data in the MICU for the period of December 2011 to May 2014. Among patients (≥80 years of age) who were survived after discharge hospital, survival rate 90 days, 1 year, 2 years, and 3 years were assessed. The survival was assessed the record of National Health Insurance Corporation medical insurance standard and the death of patients was defined as disappearance of medical insurance and the date of death was defined as day of disappearance.

**Results:** A total of 468 patients were admitted and 286 patients (male: female = 179:107, mean age = 70.9 ± 13.2) were survived and discharged. Among the patients who were alive and discharged, 69 (24.1%) were over 80 years old and 217 (75.9%) were under 80 years old. The 90-day, 1-year, 2-year and 3-year survival rates of patients older than 80 years were 50.7%, 31.9%, 15.9%, and 14.5% and the 90-day, 1-year, 2-year and 3-year survival rates of patients under 80 years old were 68.3%, 54.4%, 45.6% and 40.1%, respectively (p < 0.05).

Comparison of clinical characteristics between survived and non-survived patient after 1 year among 69 patients with ≥80 years old. The proportion of BMI ≤18 was higher in non-survivor than in survivor after 1 year among 69 patients with ≥ 80 years old. And, the duration of MV in non-survivor was longer in non-survivor than in survivor after 1 year among 69 patients with ≥ 80 years old (5.7 ± 4.5 vs 9.6 ± 8.5).

Age of ≥ 80 year old and longer ICU stay were significantly associated with non-survival after 1 year of discharge.

**Conclusions:** The long term mortality rate of the elderly patients aged 80 years or older who admitted to the ICU was low.

**Key words:** Long-term outcome, ICU, very elderly
P-024
Sevoflurane sedation with the AnaConDa: Postoperative ten Cases undergoing Head & neck surgery
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Introduction: ICU management requires mechanical ventilation. Midazolam and Propofol mainly used as profer sedation in ICU. Sevoflurane can be alternative sedation strategy in the ICU. We describe a case series and discuss benefits.

Case presentation: Ten Patients, 48-81 years old, received sevoflurane sedation in the ICU after Oropharyngeal cancer surgery. Induction time, that until sevoflurane starts and the patient reaches to RASS-3, was measured (mean ± SD, 31 ± 8.31min). The time from sedation stop to the spontaneous awakening was measured in each patient (mean ± SD 12.8 ± 6.85min). There was no adverse event such as hemodynamic fluctuation during sedation, and no agitation or delirium during spontaneous awakening.

Conclusion: Sevoflurane sedation in the ICU is safe and easy to induce sedation to the desired level, and it could be a good option for faster neurological evaluation.

Key words: ICU, Sedation, Sevoflurane

P-025
Lethal necrotizing fasciitis in plaster cast limb in a child at remote high land
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Introduction: Infections are one of the complications of plaster. Lethal complications like necrotizing fasciitis are rare with high mortality. Timely diagnosis and surgery with intensive management with the multidisciplinary approach is key for successful treatment of necrotizing fasciitis. The case was a necrotizing fasciitis with septic shock and acute renal failure managed with the limited setup in remote high altitude with a positive outcome.

Case report: Six years old child presented with acute onset of pain in the right leg with a small wound over heal following plaster application for closed undisplaced distal tibia fracture. swelling and erythema progress to the knee in 12 hours associated with fever and tachycardia. With high WBC count and rapidly progressive infection, high suspicion of necrotizing fasciitis was made. Broad-spectrum antibiotics, IV fluids, inotropes were initiated in the ward. Multiple surgeries and anesthesia without any intensive care unit, patients survived and went home on his foot after 46 days.

Discussion and conclusion: Early Suspicion and intervention of necrotizing fasciitis and sepsis is key point o patients outcome. This case concludes, even with limited setup early intervention can save a patient’s life.

Key words: Necrotising fasciitis, sepsis, renal failure

P-026
The vaster impact of inappropriate empirical antimicrobial therapy in adults with community-onset Ps
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Background: The importance of appropriate empirical antimicrobial therapy (EAT) was highlighted in the literature. However, a comparison of the impact of inappropriate EAT on outcome between adults with community-onset bacteremia caused by Pseudomonas and other causative microorganisms is lacking.

Methods: In a retrospective 7-year cohort study, adults presenting with community-onset bacteremia at the emergency department (ED) were recruited. The delayed appropriate antimicrobial administration was measured between ED triage and appropriate antibiotic agents prescribed. The primary endpoint was 28-day crude mortality.

Results: Of the 2,882 adults with community-onset monomicrobial bacteremia, those caused by Pseudomonas species accounted for 3.3% (94 patients). In comparison with the non-Pseudomonas group, patients in the Pseudomonas group were more likely to be associated with initial presentation of septic shock (P=0.001), fatal comorbidity (McCabe classification, P<0.001), bacteremia due to pneumonia (P<0.001) or...
vascular catheter-related infections ($P<0.001$), and a comorbidity of malignancy ($P<0.001$). Additionally, patient in the Pseudomonas group was frequently associated with the longer period of the delayed appropriate antibiotic therapy (mean; 73.5 vs. 24.8 hours; $P<0.001$), and thereby a higher 14-day (21.3% vs. 9.4%, $P<0.005$) and 28-day mortality rate (25.5% vs. 12.9%, $P<0.001$). In the Cox-regression after the independent predictors of 28-day mortality, the more adverse impact of inappropriate EAT on the survival with 28 days after bacteremia onset in the Pseudomonas group than that in the non-Pseudomonas group was disclosed both for the overall patients (Figure 1) and the less critically ill patients (Figure 2).

**Conclusion:** Focusing on community-onset bloodstream infection, in comparisons with other causative microorganisms, the adverse impact of inappropriate EAT on the fatality was greater in patient caused by Pseudomonas. Even in the less critically ill patients.

**Key words:** empirical therapy, Pseudomonas, bacteremia.

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**P-027**

Risk of Mortality Associated with Human Coronavirus in Adults

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**Purpose:** The purpose of the study is to describe seasonal and mortality differences of human coronaviruses (HCoVs) 229E and OC43 infection in adults.

**Materials and methods:** A retrospective cohort study was conducted on adult (≥18 years) patients admitted to the emergency department and ward of a university teaching hospital for suspected viral infection during Oct. 2012-Dec. 2017 (N = 8,071). Respiratory viruses were detected in 1,689 patients using multiplex real-time polymerase chain reaction. Of those, 134 cases of HCoVs infection were detected including 12 cases mixed infection with other respiratory viruses. HCoV229E and OC43 single infection were 44 and 78 cases, respectively. The main outcome was 30-day all-cause mortality.

**Results:** We identified 122 hospitalized adults with HCoVs infection without mixed infection. HCoV229E are predominantly detected in January and February, whereas OC43 occurred throughout the year. Sixteen hospitalized patients (13.1%) with HCoVs infection required admission to the ICU. Thirty-day all-cause mortality for 229E and OC43 was 22.7% and 11.5%, respectively. Patients infected with 229E seem to be more likely to die than those with OC43 after multivariate adjustment (OR 2.11, 95% CI 0.74-6.05).

**Conclusion:** HCoVs infections of 229E and OC43 appear to have seasonally different patterns. 229E viral infection seems to be a more severe form than OC43 in adults.

**Key words:** Coronavirus, infection, mortality

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**P-028**

Myotonic dystrophy can present with life threatening rhabdomyolysis: a case report

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**Introduction:** Myotonic dystrophy(MD) is characterized by progressive muscular weakness associated with myotonia. The disease usually progresses slowly in second, third, or fourth decades of life, and acute presentation of the disease is not recognized. Here we report a case of MD presenting with life-threatening hyperkalemia.

**Case presentation:** A 38-year-old pregnant woman, who developed omphaloproptosis at 32 gestational weeks, underwent emergent cesarean section. Preoperative blood test showed serum potassium elevated to 6.8 mEq/L, and creatine kinase elevated to 44000 IU/L. The diagnosis of rhabdomyolysis was made, but the cause could not be identified. She was stabilized by supportive therapy, and extubated on the same day. Afterward, the diagnosis of MD was made based on the presence of characteristic grip myotonia and genetic testing.

**Conclusion:** The present case exemplifies that MD can present with
acute life-threatening rhabdomyolysis.

**Key words:** Myotonic dystrophy, Rhabdomyolysis, Pregnancy

**P-029**

**Warfarin Estimated dose by Pharmacogenetic-guided Algorithms after Valve Replacement Surgery**

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**Background:** Recently, it has been recommended that initial warfarin dose determined from pharmacogenetic-guided algorithms, because warfarin has very narrow therapeutic range. The mostly commonly used algorithm is the one from ‘WarfarinDosing.org’ which is supported by the Barnes-Jewish Hospital at Washington University Medical Center, the NIH, and donations. The warfarin dose estimates are based on clinical factors such as age, ethnicity, race, weight, height, smoking, presence of liver disease, indication for warfarin treatment, baseline INR, target INR, medications which effect on cytochrome function, and genotypes of two genes: cytochrome P450 2C9 (CYP2C9) and vitamin K epoxide reductase (VKORC1). We compared the actual initial dose and estimated dose determined from pharmacogenetic-guided algorithms.

**Methods:** 35 Korean patients (38.63±9.01 years old) who underwent valve replacement surgery from 2003 to 2015 in our hospital were enrolled this study. We analyzed the CYP2C9*2 (rs1799983), CYP2C9*3 (rs1057910), and VKORC1 (rs9923231). We defined underestimated dose (patients whose estimated dose was > 20% below the actual dose), ideal dose (patients whose estimated dose was within 20% of the actual dose), and overestimated dose (patients whose estimated dose was >20% above the actual dose).

**Results:** The weight and height was 63.77±10.89 kg and 164.31±10.75 cm, respectively. All patients had wild type of CYP2C9*2. There was 1 of heterozygote (AC) of CYP2C9*3, and 34 of wild type (AA) of CYP2C9*3. There were 31 of AA type of VKORC1 which is known as warfarin sensitive type, and 4 of AG type which showed normal warfarin metabolism. The initial INR level before warfarin start were 1.21±0.13. The actual initial dose range was 3-6 mg, however the estimated dose rage was 2-4 mg. 32 patient got overestimated dose, and only 3 patient got ideal dose.

**Conclusion:** There was tendency that the actual initial warfarin dose was higher than estimated dose determined from pha

**Key words:** warfarin, Pharmacogenetic, Valve Replacement

**P-030**

**PREDICTORS AND OUTCOMES OF EXTUBATION FAILURE IN THE INTENSIVE CARE UNITS OF MAKATI MEDICAL CENTER**

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**BACKGROUND:** The decision to liberate a patient from mechanical ventilation is undertaken considering respiratory, airway and neurological parameters. However, despite optimization of said parameters, the incidence of extubation failure is reported in as much as 25% of patients.

**METHODS:** A retrospective cohort was done using data gathered from patients admitted to the medical-surgical and neuro-cardiovascular intensive units of the Makati Medical Center from January to December 2016. All patients requiring mechanical ventilation for more than 12 hours prior to extubation were included. Extubation failure was defined as re-intubation within 72 hours while the control cohort included patients successfully extubated.

**RESULTS:** Eleven out of 121 patients were found to have extubation failure. Mean age and pCO2 levels differed between the two groups with higher levels found in extubation failure patients (Mean age 73.73 ± 17.32 years, pCO2 45.64 ± 12.27 mmHg). There was a trend towards increased mortality also noted in extubation failure patients.

**CONCLUSION:** No clinical, laboratory nor bedside parameter were found to significantly predict extubation failure whose incidence was found to be 9%. Mortality rates were noted to be higher in the extubation failure patients.

**Key words:** Extubation Failure, Mechanical ventilation, intensive care unit
P-031

Vocal cord granuloma in myasthenia gravis patient: a rare cause of Failed extubation

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Introduction: Failed extubation occurs in about 10-20% of patients who are successful in weaning trials. We report a case of bilateral vocal cord granuloma as a cause of failed extubation.

Case presentation: 48 years old patient, a case of myasthenia gravis presented with myasthenic crisis. The patient was extubated after he passed the spontaneous breathing trial. He developed respiratory distress immediately after extubation and was reintubated for two times. Laryngoscopic evaluation was done, which showed bilateral vocal cord granuloma. Surgical removal of vocal cord granuloma was done. The patient was successfully extubated in the same day and had an uneventful hospital stay thereafter.

Conclusion: Vocal cord granuloma should be considered as a cause of failed extubation in patient who have passed spontaneous breathing trial. Careful manipulation of larynx during and after intubation may prevent this complication.

Key words: granuloma, weaning

P-032

Application of Bilevel Positive Airway Pressure and Mechanical Insufflator-Exsufflator

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Min Chi-Li of Respiratory therapist

A man with duchenne muscular dystrophy (DMD) has gone bedridden since grade eighth. Recently, he was sent to emergency room because of increased sputum and poor cough function. Chest radiograph showed Pneumonia. Afterwards he was admitted and then sent to intensive care unit for further treatment. Arterial blood gas data underwent therapy of inhaling Oxygen 2 liter per minute with nasal cannula that showed pH: 7.354, PaCO2: 53.8 mmHg, PaO2: 158.3 mmHg. The nature of exuded secretion of sputum was yellow-thick-like. Laboratory data of sputum culture showed mixed flora and patient was given appropriate antibiotics of piperacillin-tazobactam. Patient was suffered from nocturnal hypoxemia and poor cough function hence, we used mechanical insufflator-exsufflator (MIE) with setting of inspiratory pressure: +40 cm H2O, expiratory pressure: -50 cmH2O, inspiratory time: 2 seconds, pause time: 1 second, expiratory time: 1 second, frequency: 25 times, total 5 cycles and bilevel positive airway pressure (BiPAP) with setting of S/T+AVAPS mode, tidal volume: 400 ml, breath rate: 12 breath/min, FiO2: 28%, inspiratory positive airway pressure (IPAP): 14 cm H2O, expiratory positive airway pressure (EPAP): 6 cmH2O during the night. Consequently, patient was discharged after 30 days with BiPAP and MIE.

A characteristic pattern of muscular dystrophy is weak strength of respiratory muscle that cause poor function of inspiratory and expiratory. Progression of illness accompany with lung infection and respiratory failure, even more death. Oxygen therapy with BiPAP and MIE during preceding period improves condition of nocturnal hypoxemia and drainage of sputum. Bronchial hygiene therapy alone with appropriate antibiotics improves nocturnal hypoxemia and carbon-dioxide retention, also prevents from lung infection and intubation. Strategy used in this case provided another non-invasive treatment to improve lung ventilation and prevention of respiratory failure with BiPAP and MIE.

Key words: duchenne muscular dystrophy, bilevel positive airway pressure, Mechanical Insufflator-Exsufflator

P-033

Usefulness of noninvasive ventilation device in patients with prolonged mechanical ventilation

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Background: Weaning from prolonged mechanical ventilation (PMV) is difficult. Non-invasive ventilation (NIV) is used in numerous types of respiratory failure, but its role in PMV weaning is partially understood. We aimed to investigate the role of NIV device in patients with PMV.

Methods: We retrospectively reviewed 124 tracheostomized patients
who alternatively used NIV device after failure of spontaneous breathing trials (SBTs). We classified the patients into two groups according to weaning success. Weaning success defined spontaneous ventilation through tracheostomy without any mechanical ventilation during 7 consecutive days. Compare characteristics and the 90-day and 1-year survival rates that are associated with weaning success were evaluated. Additionally, prognostic factors associated with weaning success was investigated.

**Results:** We successfully weaned 53 patients (42.7%) from NIV device. In the weaning success group, the time from intubation to applying NIV device was short, and multiple SBTs were attempted before applying NIV device. Both 90-day and 1-year survival rate was significantly higher in weaning success group. The independent prognostic factors for weaning were cardiovascular disease as comorbidity (Hazard ratio [HR]: 2.020; P = 0.020); time from intubation to NIV (HR: 0.985; P = 0.016); concurrent attempt of SBTs at NIV (HR: 4.007; P < 0.001).

**Conclusion:** NIV might be an alternative device for difficult weaning in patients with PMV. Early application of NIV device and concurrent attempts of SBT during NIV support might enhance weaning success in patients with PMV.

**Key words:** Noninvasive ventilation, Prolonged mechanical ventilation, ventilator weaning

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**P-034**

The impact of an anesthesia protocol for enhanced recovery in recipients undergoing liver transplant

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**Background:** Enhanced recovery after surgery (ERAS) protocols accelerate patient recovery and shorten hospital stay by optimization of perioperative care. However, data on the experience and outcomes of these protocols in liver transplantation are still limited. The present study was aimed to evaluate possible improvements in the patient outcome after the implementation of an ERAS protocol in patients undergoing liver transplantation.

**Methods:** The implementation of an anesthesia protocol for ERAS was studied in recipients who underwent liver transplantation. Preoperative characteristics, intraoperative management, postoperative complications, and postoperative recovery outcomes, including extubation time, time to normal international normalized ratio (INR) of prothrombin time (PT), alanine aminotransferase (ALT) concentration at 24 hours after transplantation, acute kidney injury, intensive care unit (ICU) stay, days in hospital, the Sequential Organ Failure Assessment (SOFA) scores in the ICU, and 3-year survival rate were retrieved from the hospital database and analyzed.

**Results:** There were significant less in intraoperative fluid administration, blood loss, and blood transfusion volume in ERAS group. The ICU stay (66.1 ± 42.3 vs. 80.8 ± 48.2 hours, P = 0.045) and hospital stay (18.2 ± 8.4 vs. 22.8 ± 13.4 days, P = 0.012) were also significantly less in ERAS group. The PaO2 divide FiO2 was significantly higher and fewer patients developing acute lung injury (ALI, PaO2/FiO2 < 300, 41.6% vs. 60.8%; p = 0.020) in ERAS group. Furthermore, fewer patients developing acute kidney injury (AKI, 15.6% vs. 31.6%; p = 0.018) by using ERAS protocol. There were no differences in the total SOFA scores and 3-year survival rate.

**Conclusion:** ERAS implementation of anesthesia practice for liver transplantation at our hospital seems to be associated with the lower volumes in total fluid administration and blood loss, less perioperative blood products transfusion.

**Key words:** Enhanced recovery after surgery, outcome, liver transplantation
**P-035**

**The Improvement Project of Reducing Skin Tears Incidence in The Chronic Respiratory Care Ward**

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**Background:** Skin tears are a common occurrence in the elderly population with frail, paper-thin skin. In addition, the wound infection may become a lethal complication, which will also increase the family burden of patients and increase the cost of nursing work and medical treatment. The unit for chronic respiratory care ward (RCW), the patients mostly long-term bed, the elderly, enduring use of steroids and catheter indwelling, skin tears of a high risk group. The average rate of skin tears incidents climbed from 0.78% in April to June 2016 to 1.88% in October to December 2016. The investigation into nurses and attendants for clinical nursing and found that their cognition on skin care was not correct improper care knowledge. It raised the concern and attention of the author to set up the project group.

**Method:** To organize on-the-job education and training sessions, elderly skin care and wound care courses to enhance the safety of mobility care activities and publicize the standard operating procedures. Implement the two caregivers perform displacement, bed bath, bed scale. Enhance patient skin barrier and nutrition and edema, discussing with physicians about the changes in medicines and providing a safe care environment.

**Result:** First, the correct rate of skin care check, the correct rate from 79% to 97%, Second, turn over audit accuracy rate from 76.6% to 96.31%, Third, the incidence of skin tears after project improvement was 0.04% from July to September 2017.

**Conclusion:** Increase nursing staff awareness of the prevention of skin tears, the establishment of a good mode of care can not only reduce the incidence of skin tears per patient, improve clinical care quality and reduce medical costs, and also make staff satisfaction and teamwork harmony increased.

**Key words:** skin tears, skin tears prevention

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**P-036**

**Is National Early Warning Score useful for Rapid Response System in University Hospital?**

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**Background:** Rapid Response System (RRS) is becoming an essential system to improve patient safety and quality of care.

**Methods:** For application of RRS to our institution, we investigated in-hospital mortality, code blue incidence, and ICU admission rate, and The National Early Warning Score (NEWS) was selected as screening tool. Data were collected from adult patients admitted to Hallym University Sacred Heart Hospital for three years from 2013 to 2015. Vital signs, except for consciousness, were scored and combined for the NEWS.

**Results:** There were 116,649 admissions with 3,140,000 vital signs for three years. We excluded patients who agreed to Do Not Resuscitate (DNR) (n=2,726), pediatric patients (n=18,361), and patients who admitted to ICU (n=3,547). Mean age was 54.1 ± 17.8 years, and 41,958 patients (43.8%) were male. The In-hospital mortality rate was 0.41% (382/92,060), code blue rate was 0.15% (138/92,060) and ICU admission rate was 1.82% (1,675 / 92,060). Eighty-five percent of the patients were distributed between 0 to 4 NEWS points. Patients with positive laboratory values (pH > 7.3 or PCO2 > 30 mmHg or PO2 < 55 mmHg or Total CO2 < 12 mmol/L or K > 7 mmol/L) had significantly higher in in-hospital mortality, code blue incidence and ICU admission rates, compared to their counterpart. In the analysis using receiver operating characteristic curves, the NEWS showed high predictive power at in-hospital mortality (AUC = 0.855) and code blue rate (AUC = 0.855). The sensitivity and specificity of the NEWS of 5 points for predicting in-hospital mortality were 84.6% and 39.5%, respectively, and 89.9% and 39.5% for code blue incidence, respectively.

**Conclusions:** The NEWS of 5 points showed high sensitivity and low specificity in predicting in-hospital mortality and code blue incidence. However, the system seems to be a useful tool for early recognizing critically unstable patients in general ward.

**Key words:** Rapid Response System, patient safety, quality of care

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**P-037**

**Current status of ICU care for patients in the medical blind spot: single center review**

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In case of emergency situation, the government aid up to 3 million won plays the role of a tertiary safety system which is called emergency support (ES). However, if a patient hospitalized in intensive care unit (ICU) through emergency department (ED), medical costs are often added due to the extra circumstances. Here, we investigated the charac-
teristics and current status of patients hospitalized in ICU under ES. This is a retrospective chart review of Korea university Anam hospital from 1 January 2013 to 31 December 2017. Patients visited ED and admitted to the ICU with ES were reviewed. To compare ES patients to non-ES patients, we randomly extracted the general ICU patients in electronic medical records. Total 27 patients were hospitalized under ES during the period. The average hospital day was 10.2 days. One patient died because the caregiver refused the treatment. One was escaped the hospital, 2 were refused the treatment by themselves, and 2 were transferred to the National Hospital for further treatment and 8 were transferred to the secondary convalescent hospital for cost. There was no statistical difference in age, sex, and disease severity (APACHE-II score) compared to non ES patients. However, ES patients had shorter hospital days (10.2 vs 21.8, p=0.004), more medicare rather than general health insurance (12 (44.4%) vs 2 (8.3%), p=0.03). Alcoholics rate was higher.

We found that patients require extra medical payment when they hospitalized ICU despite the ES was provided. Besides, there were patients who gave up the ICU treatment, had a shorter hospital day than the average patient. The additional medical costs might be a burden to hamper ICU care for those patients who got ES. It is necessary to enhance the health care support programs in usual, rationalize the ES costs offer to patients who were in the medical blind spot for keeping up treatment.

Key words: Medicare, ICU, cost

**P-038**

Risk Factors for 14-day Readmission following Trauma with New Traumatic Spinal Cord Injury Diagnosis

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Objectives: Fourteen-day readmission with new traumatic spinal cord injury(tSCI)diagnosis is used as an indicator for the diagnostic quality of the first admission. In this nationwide population-based cohort study, we identified risk factors for this indicator.

Methods: We conducted a nested case-control study by using the data of patients who received a first admission for trauma between 2001 and 2011. The data were retrieved from Taiwan’s National Health Insurance Research Database. Variables including demographic and trauma characteristics were compared between patients diagnosed with tSCI at the first admission and those receiving a 14-day readmission with new tSCI diagnosis.

Results: Of the 23617 tSCI patients, 997 had 14-day readmission with new tSCI diagnosis (incidence rate, 4.22%). The risk of 14-day readmission with new tSCI diagnosis was significantly lower in patients with severe (injury severity score [ISS]=16-24; odds ratio [OR], 0.17; 95% confidence interval [CI], 0.13-0.2) and profound (ISS > 24; OR, 0.11; 95% CI, 0.07-0.18) injuries. Interhospital transfer (OR, 8.26; 95% CI, 6.48-10.38) was a significant risk factor, along with injuries at the thoracic (OR, 1.62; 95% CI, 1.21-2.18), lumbar (OR, 1.30; 95% CI, 1.02-1.63), and multiple (OR, 3.23; 95% CI, 1.86-5.61) levels. Brain (OR, 2.82), chest (OR, 2.99), abdominal (OR, 2.74) and extremity (OR, 1.52) injuries were also identified as risk factors. In addition, the risk was higher in patients treated at the orthopedic department (OR, 2.26; 95% CI, 1.78-2.87) and those of other surgical disciplines (OR, 1.89; 95% CI, 1.57-2.28) than in those treated at the neurosurgery department.

Conclusions: Delayed tSCI diagnoses are not uncommon, particularly among trauma patients with ISSs < 16 or those who are transferred from lower-level hospitals. Further validation and implementation of evidence-based decision rules is essential for improving the diagnostic quality of traumatic thoracolumbar SCI.

Key words: trauma, spinal cord injury, readmission

**P-039**

Case report: Traumatic carotid artery dissection – the importance of timely diagnosis

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Introduction: Blunt injury of the internal carotid artery is rare, but may produce a devastating outcome if not diagnosed and treated early. Diagnosis of this injury is often being missed as they usually occur in severely injured patients.

Case presentation: A young male patient, transferred from ambulance due to car accident. On arrival, the patient was unconscious with swollen face and bleeding mouth and nose. After initial management, the patient was sent to perform whole body CT and it showed multiple fractures in the facial bone, cervical, thoracic, lumbar vertebra, ribs, sternum, clavicle, scapula, femur, tibia, pubis. After initial resuscitation, the patients vital
signs were still unstable, so vascular intervention was performed. After embolization of the ruptured vessel, bleeding was controlled. In the intensive care unit, the patient stayed in deep coma, because of obvious head and neck swelling, intracranial angiography was performed, an unexpected finding was the carotid artery dissection, this caused severe compression of the true lumen and distal blood flow was slowed. After carotid artery stent implantation, blood flow of carotid artery and its branch was restored (fig.1). The follow-up brain CT showed: the right hemisphere swelling with midline shifts to the left on day 3 (fig.2), so decompression craniotomy was performed. The consciousness of the patient gradually improved but the muscle power of the left limb was level 2.

Conclusion: Traumatic carotid artery dissection (TCAD) is rare but if undiagnosed it can result in severe disability. The diagnosis of TCAD is delayed in most patient, it is often due to the multiple problems related to the trauma patient, resulting in the difficulty for timely diagnosis. TCAD should be considered in a patient with blunt injury to the neck, facial or skull bone fracture, unexplained neurological deficit, increased awareness and aggressive behavior. This will result in increased timely diagnosis of TCAD.

Key words: traumatic carotid artery dissection

P-040

Cholinergic Crisis With Cardiac Arrest Following Distigmine Bromide Overdose: A Case Report.

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Background: Cholinergic crisis causes a variety of parasympathetic symptoms. Distigmine bromide, a cholinesterase inhibitor, has been reported as a causative drug. However, cardiac arrest has not been reported as an adverse event.

Case presentation: We describe a case of a 47-year-old woman with a history of bipolar disorder, who presented with cholinergic crisis following distigmine bromide overdose and subsequently suffered from cardiac arrest. This case is not only the first report of cholinergic crisis with cardiac arrest, but also unique in that she recovered and was discharged without complications.

Conclusion: Close attention should be paid for any signs of circulatory failure in cases of cholinergic crisis with distigmine bromide toxicity.

Key words: Cholinergic crisis, Distigmine bromide toxicity, Cardiac arrest

P-041

Recurrent coronary stent thrombosis after successful weaning of Extracorporeal Membrane Oxygenation

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Introduction: Stent thrombosis (ST) is a rare but feared complication of percutaneous coronary intervention (PCI) with not only high morbidity and mortality, but also recurrence rates. We report a case of recurrent ST after weaning of extracorporeal membrane oxygenation (ECMO).

Case: A 76-year-old female, with diabetes, had undergone PCI with drug eluting stent at the left anterior descending (LAD) coronary artery 3 months ago (figure A) and been prescribed triple antiplatelet agents. She presented with chest pain. Coronary angiography (CAG) showed ST at the LAD and PCI was succeeded (figure B). However, chest pain recurred with hemodynamic instability because of re-occlusion of LAD with thrombus. While the procedure for ECMO, PCI should be repeated several times. Only after ballooning with intravenous abciximab,
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Coronary flow could be maintained. In following 5 days ECMO was weaned. On 18th hospital day, sudden hypotension with ventricular tachycardia occurred. Despite of immediate PCI, she died due to intractably recurrent ST.

**Conclusion:** Patient with ST are at high risk of thrombotic events. Therefore more potent antiplatelet or another anticoagulant regimen might be considered after ECMO weaning.

**Key word:** stent thrombosis, percutaneous coronary intervention

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**P-042**

Risk factors and outcomes of sepsis- and stress-induced cardiomyopathy in sepsis or septic shock

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**Objectives:** While both sepsis-induced myocardial dysfunction (SIMD) and stress-induced cardiomyopathy (SICMP) are common in patients with sepsis, the pathogenesis of the two diseases is different, and they require different treatment strategies. Thus, we aimed to investigate risk factors and outcomes between the two diseases.

**Methods:** This retrospective study enrolled patients diagnosed with sepsis or septic shock, admitted to intensive care unit via emergency department in Korea University Anam Hospital, and who underwent transthoracic echocardiography within the first 24 hours of admission.

**Results:** In all, 25 patients with SIMD and 27 patients with SICMP were enrolled. Chronic obstructive pulmonary disease and a history of heart failure (HF) were more prevalent in both the SIMD and SICMP groups than in the control group. The in-hospital mortality rate was significantly increased in SIMD group with EF<30% than in SICMP group with EF<30%. In multiple logistic regression analysis, a past history of diabetes mellitus (DM) and HF was significantly associated with the occurrence of SIMD. Younger age, elevated levels of NT pro-BNP, and positive result of blood culture also showed significant odds ratio regard to the occurrence of SIMD. However, only elevated lactate and troponin level were positively associated with the incidence of SICMP.

**Conclusion:** The SIMD and SICMP had different risk factors. More importantly, in-hospital mortality rate from SIMD and SICMP showed increased trend.

**Key word:** Sepsis-induced myocardial dysfunction, stress-induced cardiomyopathy, intensive care unit, sepsis, mortality

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<table>
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<th>Variable</th>
<th>SIMD (n=25)</th>
<th>SICMP (n=27)</th>
<th>Control (n=25)</th>
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<th>SICMP vs Control</th>
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<td>PaO₂, mmHg</td>
<td>58.4±29.0</td>
<td>51.6±27.5</td>
<td>51.6±29.5</td>
<td>0.11</td>
<td>0.81</td>
</tr>
<tr>
<td>PaCO₂, mmHg</td>
<td>71.4±24.2</td>
<td>109.0±47.3</td>
<td>87.7±15.8</td>
<td>0.12</td>
<td>0.04</td>
</tr>
<tr>
<td>Hemoglobin, g/dL</td>
<td>10.3±2.2</td>
<td>11.5±1.7</td>
<td>11.0±2.9</td>
<td>0.30</td>
<td>0.75</td>
</tr>
<tr>
<td>White blood cell, ×10²/µL</td>
<td>10.780±4.759</td>
<td>11.637±1.894</td>
<td>12.281±4.359</td>
<td>0.21</td>
<td>0.38</td>
</tr>
<tr>
<td>Blood urea nitrogen, mg/dL</td>
<td>28.4±23.3</td>
<td>26.6±31.4</td>
<td>27.6±23.8</td>
<td>0.40</td>
<td>0.72</td>
</tr>
<tr>
<td>Creatinine, mg/dL</td>
<td>1.28±0.84</td>
<td>1.30±0.79</td>
<td>1.34±0.85</td>
<td>0.19</td>
<td>0.28</td>
</tr>
<tr>
<td>Echocardiography, estimation rate, ml/min</td>
<td>28.4±15.8</td>
<td>28.3±26.4</td>
<td>28.1±12.2</td>
<td>0.16</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Comparison of parameters among the sepsis-induced myocardial dysfunction, stress-induced cardiomyopathy, and control groups

**Conclusion:** The SIMD and SICMP had different risk factors. More importantly, in-hospital mortality rate from SIMD and SICMP showed increased trend.

**Key word:** Sepsis-induced myocardial dysfunction, stress-induced cardiomyopathy, intensive care unit, sepsis, mortality
**P-043**

Neutrophil-to-lymphocyte ratio as a marker for unexpected cardiac intensive care unit readmission

Man-Jong Lee1,2,*, Min Jung Kim3, Mi-Hwa Park3, Jung Soo Kim1,3, Ah Jin Kim1

Division of Critical Care Medicine, Department of Hospital Medicine, Inha University Hospital, Incheon, Korea1, Division of Cardiology, Department of Internal Medicine, Inha University Hospital, Incheon, Korea2, Division of Pulmonology, Department of Internal Medicine, Inha University Hospital, Incheon, Korea3

**Background:** Neutrophil-to-lymphocyte ratio (NLR) is marker for clinical outcome in patients with various cardiovascular disease. We sought to investigate whether NLR is predicted early intensive care unit (ICU) readmission after cardiac ICU discharge.

**Methods:** The consecutive patients with cardiac ICU admissions for one year of 2017 at Inha university hospital via emergency center (EMC) were enrolled. NLR was calculated as the ratio of neutrophil to lymphocyte counts assessed by complete blood counts.

**Results:** Of a total of 590 patients, 38 (6.4%) patients were expired during index ICU admission. Among patients who underwent ICU discharge, 21 (4.0%) patients had unexpectedly transferred to ICU within 48 hours after ICU discharge. In the patients with ICU readmission, stay of ICU length, NLR at EMC, and NLR at ICU discharge were significantly elevated. (p=0.023, p=0.038, and p=0.003) Left ventricular ejection fraction was substantially reduced in the patients with ICU readmission. (51% vs. 41%, p=0.007) Causes for unexpected ICU readmission was cardiac arrest (48%), decompensation of heart failure (38%), renal replacement treatment (10%), bleeding complication (4%). Among all of ICU readmission, only 9 patients (43%) were survived to discharge.

**Conclusion:** NLR is robust predictor for early cardiac ICU readmission at the time of initial admission and ICU discharge. The leading cause for unexpected ICU readmission was in-hospital cardiac arrest, including fatal arrhythmia and myocardial infarction.

**Key word:** Neutrophil-to-lymphocyte ratio, Readmission

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**P-044**

Simple prognostic score for major adverse cardiac event in STEMI patients with cardiogenic shock

Namkyun Kim1,*, Hong Nyun Kim1, Se Yong Yang2, Myung Hwan Bae3, Jang Hoon Lee1, Dong Heon Yang1, Hun Sik Park1, Yongkeun Cho1, Sung Chull Chae1

Kyungpook National University Hospital1, Kyungpook National University Chilgok Hospital2

**Background:** Cardiogenic shock is one of challenges when managing the patient with ST-segment elevation myocardial infarction (STEMI). We aimed to investigate whether the simple age, creatinine, and ejection fraction (ACEF) score could predict 1 year major cardiac adverse events (MACEs) in the circumstance of being hemodynamic support devices such as intra-aortic balloon pump (IABP) and extracorporeal membrane oxygenation (ECMO) for high risk STEMI patients.

**Methods:** We examined 551 patients with STEMI and cardiogenic shock from the Korean Acute Myocardial Infarction Registry (KAMIR) – National Institute of Health (NIH) database. MACCEs were defined as a composition of all cause death, non-fatal MI, repeat revascularization including repeated percutaneous coronary intervention and coronary bypass grafting, cerebrovascular accident and rehospitalizations. The ACEF score was computed as follows: (age/ejection fraction) +1, if the serum creatinine was >2mg/dL. This research was supported by a fund by Research of Korea Centers for Disease Control and Prevention.

**Results:** During the one-year follow-up, 98 (17.8%) MACCEs were observed. No significant differences between the patients who used IABP (24.3% versus 18.1%, p=0.138) and ECMO (18.5% versus 21.1%, p=0.637). The ACEF score was significantly higher in the non-survivors (3.20±8.22 versus 1.47±0.62, p<0.001). Accuracy was defined through receiver-operating characteristics analysis and area under curve (AUC=0.706). Proportional hazard ratio for one-year MACCEs were 1 (reference), 1.334 (p=0.331), 2.177 (p=0.024) for
the ACEFLOW (ACEF score <1.4), ACEFMID (ACEF score 1.4 to 1.9), and ACEHIGH (ACEF score ≥ 2.0) groups, respectively.

**Conclusion:** In the survivals with STEMI with cardiogenic shock, the ACEF score may be useful prognostic model to stratify the one-year MACCEs.

**Key word:** Cardiogenic shock, STEMI, Prognostic score

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**P-045**

**Myocarditis in a previous healthy woman caused by Salmonella paratyphi enteritis**

Min-Seok Kim*, Hyo-In Choi, Sang-Eun Lee  
Asan Medical Center

**Introduction:** We report a traveller who returned from India suffering from typhoid fever.

**Case presentation:** A 54-year-old female returning traveller presented with progressive dyspnea. An ECG showed nonspecific T wave changes, with an elevated troponin and inflammatory markers. An echocardiogram showed depressed biventricular systolic function, structurally normal valves, and midventricular akinesia. Cardiac MRI revealed multifocal enhancement suggesting myocarditis. Endomyocardial biopsy revealed focal myocyte degeneration, but no evidence of myocarditis. Considering many clinical clues, we diagnosed myocarditis. Salmonella paratyphi A was isolated from blood cultures. The fever and diarrhea resolved after 2 days after admission. After 10 days of an intravenous third generation cephalosporin, the patient was discharged.

**Conclusion:** When we meet a patient with a travelling history of endemic areas, we should think this rare Salmonella infection and use intravenous antibiotics aggressively.

**Key word:** Myocarditis, Salmonella, infection

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**P-046**

**Ventricular arrhythmia induced by aconitine intoxication treated with ECMO**

Yongil Cho*, Jaehoon Oh, Hyunggoo Kang  
Department of Emergency Medicine, College of Medicine, Hanyang University

**Introduction:** We report a case of extracorporeal membrane oxygenation (ECMO) applied to patients with ventricular arrhythmia and cardiac arrest caused by aconitine intoxication and discharged with good neurological status.

**Case presentation:** A 63-year-old man visited emergency room with vomiting and dyspnea during dinner. Body temperature was 36.8, heart rate was 146, respiratory rate was 24, blood pressure was 84/40, and initial electrocardiogram (ECG) showed ventricular premature complexes in a pattern of bigeminy. One hour after the visit, pulseless ventricular tachycardia occurred, defibrillation and CPR were performed. Magnesium, lidocaine, and amiodarone were applied, but ventricular fibrillation and torsades de pointes occurred repeatedly and ECMO insertion was performed. Right femoral artery and right femoral vein were catheterized and VA ECMO applied. A total of 160 defibrillations were performed by ventricular arrhythmia until 9 hours after ingestion. ICU The ECG was stabilized within 24 hours of ICU admission, and ECMO was removed on the third day of admission. The patient was discharged on the 8th day of admission without neurological sequelae.

**Conclusions:** Aconitine can cause polymorphic ventricular arrhythmia within 24 hours of ingestion. When defibrillation and medical treatment are refractory, early ECMO should be considered.

**Key word:** Aconitine, ECMO, Ventricular arrhythmia
**P-047**

**Stroke prevalence in atrial fibrillation (AF) patients during VV-ECMO.**

Dong Hoon Kim¹, Sujin Na¹, Eun Mi Gil¹, Jeong Am Ryu¹, Chi Ryang Chung¹, Jeong Hoon Yang², Chi Min Park¹, Kyung Man Jeon¹, Gee Young Suh¹, Yang Hyun Cho³

Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea¹, Division of Cardiology, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea², Department of Thoracic and Cardiovascular Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea³

**Background:** AF is the most common arrhythmia to affect the critically ill, with an estimated incidence of 8–10% among intensive care patients. AF is also associated with a 4 to 5-fold increased risk of stroke and is responsible for approximately 15% of all strokes. ECMO in patients with AF has not been studied for the occurrence of stroke. The purpose of this study was to investigate the effect of atrial fibrillation during ECMO on stroke outcome.

**Method:** The observational study conducted in a tertiary referral center (2012-2017). Of the 687 patients who underwent ECMO, 170 patients were treated with VV-ECMO. Patients under 18 years of age, patients who underwent ECMO 2 times or more, and patients with traumatic brain injury were excluded and finally, 139 patients were analyzed.

**Result:** Of 139 patients (mean age 56.08 years, 29.7% women) enrolled. Previous AF included paroxysmal AF 8 (5.8%) and permanent AF 2 (1.4%). 37 (26.8%) developed new-onset AF during the study. Stroke occurred in 6 (14%) of the AF group and 4 (4.2%) in the non-AF group. In multivariate analysis, the association with stroke was significantly increased according to AF type (OR = 5.09, 95% CI, 1.89 - 13.69, p = 0.001). (OR = 0.12, 95% CI, 0.02-1.01, p = 0.052)

**Conclusion:** The CHA2DS2VASC score in this study was not significant in predicting stroke because the number of events was small and meaningful analysis was difficult. In patients receiving VV-ECMO treatment, AF increases the risk of ischemic or hemorrhagic stroke.

**Key word:** Stroke, Extracorporeal membrane oxygenation, Atrial fibrillation

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**Table 1.** Baseline characteristics of admission & ECMO management

<table>
<thead>
<tr>
<th>Parameter</th>
<th>No admission (N=515)</th>
<th>Admission (N=687)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>61.6 ± 13.6</td>
<td>61.5 ± 14.4</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Male (%)</td>
<td>62.0% (315)</td>
<td>61.3% (414)</td>
<td>0.59</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>37.1% (394)</td>
<td>36.8% (315)</td>
<td>0.43</td>
</tr>
<tr>
<td>Platelets (x10^9/L)</td>
<td>213 (150-325)</td>
<td>165 (120-260)</td>
<td>0.003</td>
</tr>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>12.8 ± 1.7</td>
<td>12.5 ± 1.9</td>
<td>0.018</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>1.0 ± 1.2</td>
<td>1.0 ± 1.2</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>BUN (mg/dL)</td>
<td>20.3 ± 11.7</td>
<td>20.4 ± 11.7</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>34 (15-63)</td>
<td>34 (15-63)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>21 (15-44)</td>
<td>21 (15-44)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>121 (81-277)</td>
<td>121 (81-277)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Sodium (mM)</td>
<td>139 (131-147)</td>
<td>139 (131-147)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Potassium (mM)</td>
<td>4.0 (3.8-4.2)</td>
<td>4.0 (3.8-4.2)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Chloride (mM)</td>
<td>102 (97-107)</td>
<td>102 (97-107)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>pH</td>
<td>7.40 (7.37-7.43)</td>
<td>7.40 (7.37-7.43)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>PTT (s)</td>
<td>30.0 (25.5-35.0)</td>
<td>30.0 (25.5-35.0)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>INR</td>
<td>1.1 (1.0-1.3)</td>
<td>1.1 (1.0-1.3)</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

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**P-048**

**Successful support of ECMO in cardiac arrest due to acute pulmonary thromboembolism**

Insik shin, Hui-Jae BANG*

Yonsei university, Wonju college of medicine

In the case of liver injury and femur fracture associated with trauma, the main treatment of liver injury is bed rest and conservative treatment, and femur fracture is surgical treatment. Liver injury, orthopedic surgery, and bed rest are known to be the major factors that may cause acute pulmonary thromboembolism. Pulmonary embolism may manifest as symptoms of dyspnea or anxiety, but may also manifest as severe symptoms...
such as cardiac arrest. Cardiopulmonary resuscitation in patients with cardiac arrest due to pulmonary embolism does not respond to treatment and most of them die. We report a case of acute pulmonary thromboembolism in a patient who sustained a bed rest due to traumatic liver injury and femur fracture, which was managed successfully with veno-arterial extracorporeal membrane oxygenation (ECMO) support.

**Key word:** ECMO, PTE, CRP

**P-049**

**Massive pulmonary thromboembolism developed under spinal anesthesia during ankle operation**

**Hyunyoung Lim**, Taeyeon Kim
Hanyang Medical Center

The method of a definite diagnosis of pulmonary thromboembolism (PTE) has been known as transesophageal echocardiography (TEE). However, it may not be able to detect as TEE when PTE is suddenly developed perioperatively. We describe the successful diagnosis using pulmonary angiography and resuscitation of a patient who suddenly developed PTE. A 64 years old patient who underwent spinal anesthesia for right ankle fracture operation became hypotensive, unconscious, undetectable saturation, and pulseless electrical activity after inflation of thigh tourniquet. The TEE performed during resuscitation revealed right ventricular and atrial enlargement, but not PTE. After transfer to intensive care unit, extracorporeal membrane oxygenation was used. Pulmonary angiography revealed massive PTE at both lower lung. Pulmonary embolectomy was immediate undertaken. We concluded that pulmonary angiography can be useful in the diagnosis of sudden developed PTE, undetected as TEE.

**Key word:** P-049

**P-050**

**Validation of the Korean Triage and Acuity Scale in severe trauma**

**Go Eun Choi**, Donghun Lee*
Chonnam National University Hospital

**Background:** Currently, the emergency medical centers in South Korea have used KTAS (Korean triage and acuity scale) as the initial classification tool for all patients who have visited the emergency department including trauma patients since January 2016. The present study aimed to validate KTAS for outcome in severe trauma.

**Methods:** This retrospective observational study included patients with severe trauma (an injury severity score $\geq 16$) from January 2016 to December 2017. We used Cox proportional hazards regression to estimate the prognostic impact between high acuity (KTAS level 1 or 2) and low acuity (KTAS level 3 or 4) for 30-day mortality. Kaplan-Meier survival curves were compared between high acuity and low acuity using the log-rank test.

**Results:** Of the 835 included patients, 30-day mortality was 14.9% ($n=124$). Using a Cox proportional hazard regression model, we found that high acuity increased the hazard of death (hazard ratio, 2.017; 95% CI, 1.108-3.674; $P = 0.022$). The survival curves were statistically different between high acuity and low acuity according to the log-rank test ($p < 0.001$).

**Conclusion:** KTAS shows good validity compared to existing trauma classification tools for 30-day mortality in severe trauma. Also, high acuity for KTAS showed higher 30-day mortality than low acuity for KTAS.

**Key word:** KTAS, Trauma, Outcome, Triage

**P-051**

**Acute aortic dissection developed after CPR – Transesophageal echocardiographic observations**

**Dong Keon Lee**, Sung Oh Hwang*
Seoul National University Bundang Hospital, Yonsei University Wonju College of Medicine

**Introduction:** There have been few reports regarding aortic injury caused by CPR, possible because of the low incidence of injury to the aorta or the inability to detect this complication during CPR.

**Case presentation:** A 54-year-old man presented to the ER with cardiac arrest. A TEE was performed to find out the cause of cardiac arrest. There was no abnormal finding but a focal separation of the intimal layer at the anterior wall of the descending thoracic aorta (Fig. 1A). After 19
minutes of resuscitation, the return of spontaneous circulation (ROSC) was achieved. Ten minutes after ROSC, his systolic BP dropped to 80 mmHg. Follow-up TEE revealed an intimal flap, not seen on the first TEE, in the DTA (Fig. 1B). The intimal flap was observed between the distal portion of the aortic arch and 11 cm down from the aortic isthmus (Fig. 1C)(Fig. 2).

**Conclusion:** Aortic dissection is a rare complication of CPR. TEE can be a useful mean for early detection of aortic injury associated with CPR.

**Key word:** cardiopulmonary resuscitation, aortic dissection, complication

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**P-052**

**Neurologic outcome in OHCA patients with subsequent shockable rhythm conversion**

**Kap Su Han**, **Su Jin Kim**, **Sung Woo Lee**, **Euijung Lee**

Korea University Anam Hospital

**Background:** Patients with out-of-hospital cardiac arrest (OHCA) is known to have a good neurological prognosis when the initial rhythm is shockable. However, the prognostic significance of conversion from non-shockable to shockable rhythms during the course of resuscitation remains unclear. In this study, we aimed to report the prognosis in OHCA patients with initial non-shockable rhythm subsequently converted to shockable rhythm.

**Methods:** We used a Korean national OHCA cohort of korea CDC database from 2012 to 2016. For all EMS-treated adult (20 and older) OHCA patients with presumed cardiac etiology, we compared neurologically favorable survival to discharge (cerebral performance score 1-2). Patients who were transferred from the ED to other hospitals, those whose families refused further resuscitation were excluded. Multivariable logistic regression was used to adjust for potentially confounding variables.

**Results:** Of the 142,905 patients with OHCA, 51,201 were included in this analysis. Patients (N=6,931) presented in shockable rhythm (6,931 patients) at initially, patients (N=3,018) presented in non-shockable rhythm converted to a shockable rhythm at pre-hospital stage, patients (N=10,300) presented in non-shockable rhythm converted to a shockable rhythm at emergency room, patients (N=30,952) who did not converted to shockable rhythm had a good neurologic outcome 31.5%, 11.1%, 3.8%, 2.3%, respectively (p<0.05). After adjusting for confounders, conversion to a shockable rhythm at prehospital was associated with good neurologic outcome (OR 1.77, 95% CI: 1.47-2.13). But conversion to a shockable rhythm at emergency room was no associated with good neurologic outcome (OR 1.10, 95% CI: 0.91-1.33).

**Conclusion:** In nationwide OHCA database cohort, OHCA patients who converted to a shockable rhythm during pre-hospital stage show better neurologic outcome than who did not converted.

Funded by national research foundation of korea, 2017RIA2B1005037

**Key word:** cardiac arrest, non-shockable rhythm, neurologic outcome

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**P-053**

**Cerebral Metabolism Monitoring for Post Cardiac Arrest, a Pilot Study**

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Department of Emergency Medicine, Ajou University School of Medicine1, Department of Neurology, Ajou University School of Medicine, Suwon, Republic of Korea2, Department of Emergency Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine3

**Introduction:** For better care of post cardiac arrest patients, objective serial assessments of brain injury severity are needed. We hypothesized that monitoring of cerebral energy metabolism based on arterio-jugular AJ differences of metabolites will provide serial details of brain injury and information about neurologic outcomes in patients.

**Methods:** Measurements of lactate and glucose in addition to blood gas
analyses were done every 6 hours from the radial artery and jugular bulb in post cardiac arrest patients throughout targeted temperature management (TTM). Jugular bulb saturation, AJ difference of O2 and AJ difference of lactate (AJDL) were calculated and compared between the different neurologic outcome groups. Linear mixed-model analysis was done to assess AJDL based on the different phases of TTM and neurologic outcome.

**Results:** A total of 13 patients were included in the study (N = 4 good outcome, N = 9 poor outcome). AJDL as an indicator of cerebral metabolism was significantly different between the outcome groups and demonstrated negative values in the poor neurologic outcome group (0.06 [0.05–0.09] vs. -0.14 [-0.06–-0.27], p < 0.01). However, there was no significant difference in AJDL between the outcome groups in the mixed effects model (p = 0.05). Also, there were no differences between the phases of TTM in both groups (p = 0.46).

**Conclusions:** AJDL was observed to be informative but was not significantly different between neurologic outcome groups throughout the different phases of TTM in our pilot study. Future studies are needed for further investigation of AJDL as an indicator of brain injury severity.

**Key word:** Heart Arrest, Brain Injuries, Energy Metabolism

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**Introduction:** Abdominal compartment syndrome (ACS) is a serious disease that develops from intraabdominal hypertension and leads to on multiple-organ dysfunction.

**Case presentation:** A 45-year-old male with ventricular fibrillation arrest was admitted to an intensive care unit after extracorporeal cardiopulmonary resuscitation. The patient showed severe abdominal distension with large amount of blood in a nasogastric tube drainage on the next day. Abdominal ultrasound revealed severe bowel distention with fluid collection. Bedside laparotomy and decompressive jejunostomy was urgently performed to resolve progression to ACS. After the procedure, his hemodynamic deterioration was recovered quickly. He was transferred to the general ward after weaning of ventilator and dialysis while keeping jejunostomy on the 18th day of admission.

**Conclusion:** Early diagnosis and proper treatment of ACS, including bedside laparotomy, are needed to prevent hemodynamic deterioration and organ failure.

**Key word:** Abdominal compartment syndrome, Laparotomy, Emergency care

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**P-054**

**A case of abdominal compartment syndrome treated with emergent bedside laparotomy**

**Gun Woo Koo**, Yeonkyung Park, Dong Won Park, Ji-Yong Moon, Jang Won Sohn, Ho Joo Yoon, Sungghwan Hwang, Sang-Heon Kim, Hyun-il Kim, Tai Sun Park

Department of Internal Medicine, Hanyang University College of Medicine, Seoul, Korea, Department of Internal Medicine, Hanyang University Guri Hospital, Guri, Korea, Department of Surgery, Hanyang University Guri Hospital, Guri, Korea

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**P-055**

The Clinical Characteristics and Risk Factors of Critical Illness–related adrenal insufficiency

Heung Bum Lee*, Seung Yong Park, Jae Seok Jeong, Yeong Hung Choe, So Ri Kim, Seoung Ju Park, Yong Chul Lee

Department of Internal Medicine, Chonbuk National University Medical School

**Introduction:** Cortisol is necessary to survive critical illness, but the optimal level is unclear. Absolute adrenal insufficiency is rare among critically ill patients and the incidence is estimated to be less than 3%. However, relative adrenal insufficiency (RAI) has been reported as a predictor of mortality in critical illnesses including septic patient, its effects on clinical outcome and risk factors for critically ill patients are controversial.

**Objectives:** To assess the clinical characteristics and risk factors of RAI in critically ill patients.

**Methods:** We retrospectively assessed the medical records of 237 patients who checked a random cortisol in the Medical Intensive Care Unit (MICU) at the Third University Hospital, from January 2016 to February 2017.

**Results:** Of the 237 cases, 62 patients with a risk of RAI (random cortisol levels <34 μg/dL) were included, and ultimately 48 patients had relative adrenal insufficiency (77.4%). The length of MICU stay day (12.7±10.2 vs. 10.3±9.6, p=0.437) and mortality rate (27/48 vs. 10/14, p=0.308) were not statistically different between two groups (RAI + vs RAI -, respectively). There was no significant difference between the RAI positive group and the negative RAI group in baseline characteristics such as age, sex and other clinical features. In subjects who had random cortisol levels of 15 μg/dL to 34 μg/dL (n = 33), the incidence of RAI was 19 (57.6%) and a positive result of cosyntropin stimulation test was associated with sepsis-related syndrome (16/33, 84.2%, OR 9.27, 95% CI 1.25-68.70).

**Conclusions:** In critically ill patients, RAI is relatively common but it was not associated with deteriorated outcomes in this study. However, in subjects with random cortisol levels between 15 μg/dL and 34 μg/dL, sepsis-related syndrome may be a risk factor for relative adrenal insufficiency.

**Key word:**

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**P-056**

Characteristics of patients with hematological malignancies in the medical intensive care unit

Jin-Jin Kim¹, Seok chan Kim³, Jong Wook Lee³, Hee-Je Kim³, Hyonsoo Joo²

Cardiovascular Center and Cardiology Division, Yeouido St. Mary’s Hospital, The Catholic University of Korea¹, Division of Pulmonology and Critical Care Medicine, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea², Department of Hematology, Catholic Blood and Marrow Transplantation Center, Leukemia Research Institute, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea³

**Background:** Patients with hematological malignancies admitted to an intensive care unit (ICU) generally have high mortality rate. The aim of our study is to analyze clinical characteristics, treatment and outcome of such patients.

**Methods:** We retrospectively chart reviewed in the intensive care unit of Seoul St. Mary’s Hospital from January 2017 to December 2017.

**Results:** A total 295 patients were included in this study. There were 149 (50.5%) males and 146 (49.5%) females with median age of 53.98 years (17~83 years). Main diagnosis was acute myeloid leukemia in 105 (35.6%) followed by multiple myeloma in 53 (17.9%) and lymphoma 49 (16.6%). Most of patients 73.3% were on active chemotherapy at the time of admission to ICU. The most common reason for admission to ICU was combination of respiratory failure with septic shock (38.8%) followed by respiratory failure alone (21.5%) and septic shock (13.9%). The mean Acute Physiology and Chronic Health Evaluation-II score was 20.68 points. The mean duration of ICU stay was 10.36 days. A total of 164 (55.6%) patients expired while in ICU, while 209 (70.8%) died in hospital after being transferred to general ward.

**Conclusions:** Admission of patients with hematological malignancies to the intensive care unit is associated with poor outcome and high mortality. Further studies are needed on the factors that affect survival.

**Key word:** Hematological malignancy, ICU, survival, treatment

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**P-057**

Risk factors of intensive care unit readmission after liver transplantation

Young Gon Son, Ho Geol Ryu*

Department of Anesthesiology, Seoul National University College of Medicine

**Background:** Most liver transplant patients require intensive care unit
(ICU) care in the immediate postoperative period and some patients require readmission to the ICU before discharge from the hospital. A retrospective cohort study was conducted to identify risk factors of ICU readmission after liver transplantation.

**Methods:** Adult patients who underwent living donor or deceased donor liver transplantation at Seoul National University Hospital between 2004 and 2015 were included. A retrospective review of baseline and perioperative factors that may be associated with ICU readmission was performed. Patients requiring ICU readmission during the hospitalization for LT (readmission group) were compared with patients who did not need ICU readmission (control group). A multivariable logistic regression analysis was performed to identify predictors of ICU readmission after LT.

**Results:** Of the 1181 patients, 68 patients (5.8%) were readmitted to the ICU during the postoperative period after liver transplantation. Common causes of ICU readmission included postoperative bleeding, pulmonary complications, and sepsis. Multivariable analysis revealed old age (OR 1.030 95%CI 1.002-1.059, p=0.035), pre-transplant renal failure (OR 4.912 95%CI 2.556-9.439, p<0.001), intraoperative red blood cell (RBC) transfusion (OR 1.029 95%CI 1.008-1.050, p=0.007), new onset atrial fibrillation in the ICU (OR 2.807 95%CI 1.087-7.249, p=0.033), and transplantation between 2011 and 2015 (vs. 2004-2010) as risk factors of ICU readmission after LT.

**Conclusion:** Old age, pre-transplant renal failure, more intraoperative RBC transfusion, new onset atrial fibrillation during ICU stay, and transplant period were identified as risk factors of ICU readmission.

**Key word:** intensive care unit, liver transplantation, readmission

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**P-058**

**Effect of patient-directed interactive music therapy on sleep quality of critically ill patients**

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Sleep deprivation exacerbates psychophysiological and mental dysfunction and interferes with recovery from illness in ICU patients. Among non-pharmacological approaches to alleviate such sleep disturbance, music effectively induces relaxation in patients. This study aimed to examine how engagement in a music therapy intervention affects the sleep quality of ICU patients. A total of 121 ICU patients ages 65 years and over were randomly assigned to one of three groups: patient-directed interactive music therapy (PD-IMT), passive listening (PL), or control group. The PD-IMT group participated in a music therapy intervention in which each patient engaged in (a) breathing control training with music and interactive music making during the daytime and (b) music listening at nighttime. The PL group listened to music at nighttime without music intervention during the daytime. The control group received only traditional care. The Richard Campell Sleep Questionnaire (RCSQ) and the Quality of Recovery (QoR) were self-rated by patients at three time points: pre-operation day (T0), one day after operation as pretest (T1), and two days after operation as posttest (T2). Linear mixed model results showed that the interaction effect of time and group was significant in both measures. Post hoc analyses demonstrated that for the RCSQ, the difference between T1 and T2 was significant only in the PD-IMT group (p = 0.005). For the QoR, while the control group showed a significantly decreased recovery score between T0 and T2 (p < 0.001), such decrease was not significance in the PD-IMT and PL groups, indicating that the patients in the two groups showed increased health condition more similar to their pre-operative level. These results support that PD-IMT improved the sleep quality of ICU patients by enhancing patients’ self-control of attention and breathing, decreasing stress-related factors leading to sleep disturbance, and facilitating their maintenance of the sleep-wake cycle.

**Key word:** ICU, Sleep Hygiene, Music Therapy

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**P-059**

**Clinical usefulness of mBWAPscoring as a predicting tool of ventilator weaning**

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**Background:** The purpose of this study was to determine the usefulness of modified Burns Wean Assessment Program (mBWAP) scoring as a predicting ventilator weaning tool.

**Methods:** This prospective observational study was conducted from Oct
1, 2014 to Sep 30, 2017 in a medical intensive care unit (ICU) of Pusan National University Hospital. All patients who were treated with ventilator care more than 72 hours were screened and patients with more than one spontaneous breathing trial (SBT) were finally enrolled. The mBWAP scoring for all enrolled patients was measured by a respiratory therapist.

Results: A total of 183 patients were enrolled. Their median age was 70 (range 17-89) and 131 patients (71.6%) was male. Pneumonia (n=142, 77.6%) was the most common cause of ventilator care. ICU mortality rate was 13.7% (n=25). The median duration from admission to first SBT was 6 days (range 3-26), forty-nine patients (26.8%) received more than two SBT, and final weaning success rate 88.0% (n=161). Patients with the final weaning success had significantly higher mBWAP score than those with weaning failure. [median 65 (range 43-85) vs 51 (31-80), p<0.001]. The area under the curve of mBWAP for predicting ventilator weaning was 0.755 (95% confidence interval 0.686-0.816) and the cut-off value based on maximum Youden’s index was ≥ 55, with a sensitivity of 76% and specificity of 72%. Also the mBWAP score in patients with final weaning success was negative correlation with age ([γ = -0.348, p<0.001], Charlson’s comorbidity index ([γ = -0.236, p=0.003], and Acute Physiology and Chronic Health Evaluation II score on first day of ICU admission ([γ = -0.203, p=0.010]), respectively.

Conclusion: In our study, the mBWAP score measured by a respiratory therapist had useful predictive performance of ventilator weaning. In patients with weaning success, this score had negative correlation with age, comorbidity, and severity on first ICU admission.

Key word: modified Burns Wean Assessment Program (mBWAP), ventilator weaning

P-060
Neostigmine as salvage management for sudden bronchospasm after cisatracurium infusion

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Introduction: Cisatracurium-induced anaphylactic reaction, including severe bronchospasm or allergic myocardial infarction is rare, but it can present life-threatening nature.

Case presentation: A 52-year-old male was admitted for ST-segment elevation myocardial infarction, following of sudden cardiac arrest. Facilitating mechanical ventilation for pulmonary edema, we planned use of cisatracurium. After cisatracurium infusion, tidal volume was suddenly dropped and oxygen saturation decreased to less than 60%. Repeated epinephrine and methylprednisolone were given. However, inappropriate ventilation with high airway pressure was remained. Arterial gas analysis was demonstrated severe respiratory acidosis. The neostigmine was given as adjunctive management. Twenty minutes later, patient was recovered to previous status.

Conclusion: Intensivists should be aware that cisatracurium as neuromuscular blockade can cause severe bronchospasm and neostigmine can be used to reversal agent.

Key word: Cisatracurium, Bronchospasm, Neostigmine

P-061
The Short-term Outcomes of Cardiovascular Surgery in Octogenarians

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Background: Age remains a significant and unmodifiable risk factor for cardiovascular diseases. Because the elderly are increasingly referred for operation, we reviewed the short-term outcomes of cardiovascular surgery in patients of 80 years or older.

Methods: In the retrospective study we analyzed patients aged ≥ 80 years old, who underwent cardiovascular surgery(cardiac valve, coronary disease, aorta disease) between 2014 and 2015 at our Institution. Euroscore II, postoperative(postop) intensive care unit(ICU) stay, hospital mortality were evaluated. Data was obtained from medical records.

Results: Patients over 80 years old was 45(Group A) and 413 patients(Group B) were over 70 years old and younger than 80 years aged. Compared with Group B, Group A had older median age(81[interquartile range(IQR), 80~84] vs. 74[IQR, 72~76]), higher EUROSORE II(6.2[IQR, 2.6~14.4] vs. 2.3[IQR, 1.4~4.8]; p<.001). We evaluated 2 short-term postop outcomes: postop ICU stay, hospital mortality. Postop ICU median stay of group A was longer than group B, but there was no statistical significance. Hospital mortality of group A was 8(17.8%) and Hospital mortality of group B was 45(10.9%). Also there was no statistical significance.

Conclusion: Cardiovascular operations are successful in most octogenarians with increased hospital mortality, and longer postop ICU stay, although not statistically significant. Further studies on long-term survival and quality of life long-term survival are needed.

Key word: cardiac surgery, octogenarians
**P-062**

**Bedside PICC by Intensivist in ICU**

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**Introduction:** Peripherally inserted central catheter (PICC) in patients with mechanical ventilation or physiologic instability can be a reasonable choice in alternation of central catheter in intensive care unit (ICU). However, bedside PICC insertion without fluoroscopy guide in ICU often encounter challenging problems.

**Methods:** We retrospectively reviewed the procedure related problems and indwelling duration of in-ICU bedside PICC insertion by intensivist. All bedside PICC insertion was inserted by two full time intensivist (medical and neurologic intensivist) with ultrasound guiding. Length of catheter was determined by bedside measuring.

**Results:** From April, 2016 to December 2017, 115 PICCs were inserted at bedside and procedure related problem was occurred in 11 cases (9.6%); twisted tip to form ‘U’ shape in 5 cases (4.3%), tip to internal jugular vein in 4 cases (3.5%), tip in contralateral subclavian vein in 1 case (0.9%) and venous puncture failure in 1 case (0.9%). Final PICC tip location was superior vena cava in 55 cases (47.8%), right atrium in 47 cases (40.9%), ipsilateral subclavian vein in 7 cases (6.1%), inferior vena cava in 3 cases (2.6%) and contralateral subclavian vein in 1 case (0.9%). No clinically fatal complication developed after bedside PICC insertion. Observed mean indwelling duration was 17.3 ± 18.3 days. In 21 cases, PICCs were indwelled until patient death and 28 patients (24.3%) discharged hospital with indwelling PICC. Identified reason of PICC removal was infection suspicion in 6 cases (5.2%), dispensability in 6 cases (5.2%), malfunction in 3 cases (2.6%) and accidental removal in 1 case (0.9%).

**Conclusion:** Bedside ultrasound guided PICC insertion in ICU is safe with acceptable complications.

**Key word:** Peripherally inserted central catheter, PICC, catheter, mechanical ventilation

**P-063**

**Concurrent use of haloperidol with antimicrobials or prokinetic agents in intensive care units**

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**Background:** Polypharmacy is known to be common among critically ill patients and is associated with increased drug-drug interactions (DDIs), adverse drug events and healthcare costs. Delirium is prevalent in critically ill patients and quetiapine has been considered as a choice for delirium management. This study was performed to investigate potential DDIs of quetiapine with other medications, especially focused on antimicrobials and prokinetic agents in critically ill patients.

**Methods:** We analyzed Health Insurance Review Agency National Inpatients Sample (HIRA-NIS) database between 2014 and 2015, which included 13% of all the hospitalized patients in Korea. We included adult patients (20 years or older) admitted to the ICU taking haloperidol. The severity of DDIs with risk rating level X or D in Lexi-Interact™ online or contraindicated or major level in Micromedex® were included. SAS version 9.4 was used for statistical analysis.

**Results:** A total 4,390 ICU patients with 23,441 DDI prescriptions were included. The largest age group was 75 years or older (1,724, 39.3%) and 2,868 patients (65.3%) were male. The mean number of DDI cases was 5.3 per patient. There were total 23,441 cases of DDIs of haloperidol with antimicrobials or prokinetics of which interaction risk rating level X or D in Lexi-Interact™ online or contraindicated or major level in Micromedex®. Most common DDIs of haloperidol with severity level were metoclopramide (6,147, 26.2%), followed by metronidazole (4,766, 20.3%), levofloxacin (3,930, 16.8%) and ciprofloxacin (2,942, 12.6%).

**Conclusion:** The most commonly used medications with haloperidol with severity interaction levels was metoclopramide and metronidazole with frequency of 26% and 20%, respectively. Potential DDIs with haloperidol were common in ICU setting, suggesting optimal medications use and supportive interventions by clinical professionals are required in this population.

**Key word:** Intensive care units, drug interactions, haloperidol

**P-064**

**A Potential Drug Interaction of Quetiapine in Critically Ill Patients in Korea**

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**Background:** Polypharmacy is known to be common among critically ill patients and is associated with increased drug-drug interactions (DDIs), adverse drug events and healthcare costs. Delirium is prevalent in critically ill patients and quetiapine has been considered as a choice for delirium management. This study was performed to investigate potential DDIs of quetiapine with other medications, especially focused on antimicrobials and prokinetic agents in critically ill patients.

**Methods:** We analyzed Health Insurance Review Agency National
Inpatients Sample (HIRA-NIS) database from 2014 to 2015 in Korea. Adult patients aged 20 years or older and admitted to the intensive care units (ICUs) were included for this study. We analyzed concurrent use of quetiapine with antimicrobials or prokinetics at least one day, which could increase the risk of QT prolongation. Analysis of DDIs was conducted using Lexi-Interact™ online and Micromedex®. SAS version 9.4 was used for data analysis.

Results: A total number of ICU patients were 73,968 with 88,449 prescriptions. The largest age group was 75 years or older (23,532, 31.8%) and 42,496 patients (57.5%) were male. The mean number of DDIs cases was 10.2 per patient. There were total 46,234 cases of DDIs of quetiapine with antimicrobials or prokinetics of which interaction risk rating level D or X based on Lexi-Interact™ and major or contra-indicated severity level in Micromedex®. Most common DDIs with severity level were metoclopramide (10,199, 22.1%), followed by metronidazole (9,345, 20.2%), levofloxacin (7,654, 16.6%), ciprofloxacin (6,155, 13.3%) and domperidone (2,351, 5.1%).

Conclusion: Quetiapine with metoclopramide or metronidazole was commonly used in critically ill patients. These medications have potential DDIs which could increase the risk of adverse events such as QT prolongations. Thus, drug monitoring strategies in ICUs are required to prevent potential adverse events in critically ill patients.

Key word: Intensive care units, drug interactions, quetiapine

P-065

Modified ultrasound assisted central vein catheterization is simple and feasible method in ICU

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Background & objective: Central vein catheterization is a commonly performed procedure in intensive care unit (ICU). However, several studies using traditional landmark-based blind methods have reported considerable occurrences of procedure failure and complications as high as approximately 30% and 19%, respectively. To overcome such shortcomings, ultrasound (US) has been used as a guidance for central vein catheterization (CVC). Nonetheless, majority of physicians feel use of real-time US guidance was not comfortable in a real world because of its usage complexity and no equipment of the device in the ICU. The purpose of our study was investigate whether to show modified US-assisted CVC was simple and feasible method, as compared with the previous blind methods for CVC.

Methods: We retrospectively reviewed 103 patients who admitted and were executed CVC to department of neurology and in ICU from March 2015 to October 2016. Forty patients who had CVC as a radiological consultation were excluded. Enrolled patients were divided into US guided and control groups. US-assisted CVC was modified as a drawing method on course of target vessel using a surgical marker and was started catheterization. Baseline characteristics, insertion site, procedure time were analyzed between the groups.

Results: All 63 recruited patients with CVC were analyzed as: 36 jugular (57.1%), 21 subclavian (33.3%), and 6 femoral (9.5%) veins. Modified US assisted CVC was applied at 24 cases and all of 24 cases were executed at jugular vein. There was a significant procedure time reduction in our modified US-assisted catheterization than the landmark-based blind method (13.3 ± 5.4 min vs. 23.4 ± 8.0 min, p<0.001). 2 cases of pneumothorax was occurred in control group, but no event in US-guided group. Baseline characteristics had no significant difference between two groups.

Conclusions: Our findings suggests that modified US-assisted CVC is a simple and feasible method in the ICU setting.

Key word: Central vein, US-guided, modified method

P-066

Disagreement between FloTrac® system and BioZ® system for stroke volume variation measurement

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Background: For patients with sepsis and septic shock, we recommend the infusion of intravenous fluids (30mL/kg) within the first three hours of presentation, rather than vasopressors, inotropes, or red blood cell transfusions. Static or dynamic predictors of fluid responsiveness should be employed in order to determine further fluid management. Guidelines state a preference for dynamic measures (eg, SVV, PPV etc) since they are more accurate than static measures (eg, CVP) at predicting fluid responsiveness. The objective of this study is To determine the agreement between stroke volume variation (SVV) measured simultaneously by the FloTrac®/Vigileo® system and BioZ® system to assess fluid status in patients with sepsis or septic shock.

Methods: In this retrospective observational study, we evaluated the medical records of patients who monitored by stroke volume variances parameters measured simultaneously by the FloTrac®/Vigileo® system and BioZ® system in patients with sepsis or septic shock.
intensive care unit at a tertiary university-affiliated hospital, from January 2017 to December 2017.

**Results:** Total 14 patients with sepsis or septic shock were analyzed. No significant correlation was observed between central venous pressure and SVVs measured by the FloTrac®/Vigileo® system and BioZ® system (CVP vs. SVV (the FloTrac®/Vigileo®); r = -0.063, P=0.488, CVP vs SVV (BioZ®); r = -0.199, P=0.027, SVV (the FloTrac®/Vigileo®) vs SVV (BioZ®); r = 0.048, P=0.597). and there was no agreement between central venous pressure and SVVs measured by the FloTrac®/Vigileo® system and BioZ® system (CVP vs. SVV (the FloTrac®/Vigileo®); kappa = 0.057 ± 0.157, CVP vs SVV (BioZ®); kappa = 0.039 ± 0.049, SVV (the FloTrac®/Vigileo®) vs SVV (BioZ®); kappa = 0.005 ± 0.108).

**Conclusion:** Our study showed disagreement the hemodynamic parameters measured by one of the two devices and it should be interpreted with caution before therapeutic interventions.

**Key word:**

P-067

Effect of non-pharmacological interventions to prevent ICU delirium: A meta-analysis

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**Background:** The incidence of delirium in intensive care unit is high and it is associated with various negative impacts of patients and causes workload and stress to the medical staff. The SCCM guidelines recommend non-pharmacological interventions to prevent ICU delirium but it was limited. This study was a meta-analysis to identify effects of non-pharmacological interventions to prevent ICU delirium.

**Methods:** Search and selection of literature was made on the basis of the PRISMA flow chart. We researched the following five databases (2007-2016): MEDLINE, Cochrane, CINAHL, PsycInfo, and Embase. To evaluate the quality of studies, we utilized the Cochrane collaboration’s tool and the Newcastle-ottawa scale. Comprehensive Meta-Analysis® software 3.0 was used to analyze the odds ratio effect size, the total effect size, sub-groups analysis, publication biases, and sensitivity analysis.

**Results:** 35 interventions were included for the meta-analysis. Non-pharmacological interventions to prevent ICU delirium were classified into 11 categories- multi-protocol(10), environment(10), ABCDE bundle(3), partial ABCDE bundle(2), daily interruption of sedation(2), exercise(2), patient education(2), automatic warning system(1), cerebral hemodynamics improving(1), family participation(1), sedation reducing protocol(1). The effect size of preventive non-pharmacological interventions to delirium incidence was OR= 0.70 (95% CI, 0.56-0.87), to duration of delirium was OR= 0.24 (95% CI, 0.07-0.88), to ICU length of stay was OR= 0.86 (95% CI, 0.76-0.97), and to ICU mortality was OR= 0.89 (95% CI, 0.82-0.98).

**Conclusion:** Non-pharmacological interventions to prevent ICU delirium was effective to ICU patients. It is necessary to apply and development non-pharmacological interventions in ICU consistently.

**Key word:** ICU, delirium, meta-analysis
P-068
Risk factors and timing of sepsis-3 in severe trauma patients: A 3-years single center experience

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Background: Because sepsis definition was changed recently, we expected that timing of sepsis could be measured easily to trauma patients who already present systemic inflammatory response syndrome initially. Moreover, we investigated to risk factors of sepsis according to new sepsis definition.

Methods: From Jan 2014 to Dec 2016, trauma patients in single level I trauma center were retrospectively reviewed. Exclusion criteria was as follows; under 18 years old, ISS (Injury Severity Score) <15, Length of stay <8 days, Transferred from other hospital, Uncertain trauma history, incomplete medical records. Sepsis was defined that increased in the Sequential Organ Failure Assessment score of 2 points or more by infection. Binary logistic regression test was utilized for identify the risk factors of sepsis.

Results: Total 3869 patients were included and after exclusion, 422 patients were reviewed. 50 (11.85%) patients were diagnosed the sepsis. Sepsis group presented higher mortality (14 (28.0%) vs 17 (4.6%), p<0.001) and longer intensive care unit stay (23 [11–35] vs 3 [1–9], p<0.001). In multi-variable analysis, male (3.254 [1.009–10.493], p=0.048), ISS (1.062 [1.024–1.102], p=0.001), lactate (1.181 [1.028–1.357], p=0.019) and red blood cell transfusion in 24 hours (1.061 [1.028–1.094], p=<0.001) were risk factors of sepsis. Median timing of sepsis was at 8 [6–11] days of hospital days and 4 [3–6] days of post-operative days. Most common focus was respiratory system (66.0%).

Conclusion: New definition of sepsis is still critical to severe trauma patients. Male patient who had higher ISS, lactate and red blood cell transfusion should be cared cautiously. Because emergency operation did not increase risk of sepsis in multi-variable analysis, active bleeding control could be considered for reduce the blood transfusion. Lung care was important and re-assessment for sepsis might be considered in 8 hospital days.

Key word: sepsis, trauma, risk factor

P-069
Polymyxin B hemoperfusion treatment in septic shock due to Necrotizing soft tissue infections

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Introduction: Endotoxin is considered one of the principle biological substances implicated in the genesis of septic shock. The patient was septic shock due to necrotizing soft tissue infections. We tried to remove toxin by using Polymyxin B Hemoperfusion cartridge.

Case presentation: The patient is a 60-year-old female with a history of B-cell ALL. During chemotherapy, she appeared to be in neutropenic fever, right forearm redness and shock. MRI showed fasciitis involving deep fascia in medial aspect of right forearm. Her medical condition was very poor, so we applied an endotoxin removal cartridge. The day after using filter, shock was recovered. On ICU day 8, she was transferred to general ward.

Conclusion: Necrotizing soft tissue infections are characterized by fatal clinical course without early surgical debridement. If surgery is difficult for a variety factor, Polymyxin B Hemoperfusion has been used as a rescue treatment for severe sepsis.

Key word: Polymyxin B, Septic shock, Hemoperfusion
P-070
Outcomes of Polymyxin B hemoperfusion and therapeutic plasma exchange in patients with septic shock
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Aims: To analyzed patients with septic shock treated with TPE and compared them with those treated with PMX-HP. We also analyzed the timing of appropriate intervention.
Methods: We performed a retrospective observational single-centre study of 56 patients who underwent TPE (n = 21) or PMX-HP (n = 35) as a rescue therapy in patients with septic shock from January 2015 to December 2017. Propensity score matching was used for adjusted analyses.
Results: Thirty-nine patients were male (69.6%), mean age was 60.6 years. There were no significant differences in sex, age, underlying disease and baseline SOFA score between TPE and PMX-DHP group. Unlike PMX-HP, which was used more frequently in gastrointestinal tract infection (23/35 patients, 65.7%), TPE was more used in pulmonary-origin infection (10/21 patients, 47.6%). Overall 28-day survival after intervention was 44.6%. The mortality rate was no statistically significant difference between two groups. In 28-day survival group, lactate levels just before the intervention were lower (5.8±3.5 vs 9.7±4.7, p=0.001), interval from blood culture to intervention (25.9±14.8 vs 100.3±150.2, p=0.021) and interval from vasopressor administration to intervention (20.2±19.1vs 142.9±304.7, p=0.028) were significantly shorter than non-survivor group. Lactate level just before the intervention had predictive validity (AUROC = 0.74; 95% CI, 0.62-0.86), cut-off value was 7.2 mmol/L (sensitivity 70.6%, specificity 66.7%). Lactate level just before the intervention had predictive validity (AUROC = 0.74; 95% CI, 0.62-0.86), cut-off value was 7.2 mmol/L (sensitivity 70.6%, specificity 66.7%). Mortality at 28 days was 71% in patients with lactate more than 7.2, and 29% in less than 7.2 mmol/L (OR 4.346; 95% CI 1.409-13.402; p = 0.009).
Conclusions: The clinical outcomes of TPE to treat septic shock were similar to that of PMX-HP. The lactate level just before the intervention was a determinant of prognosis.
Key word: polymyxin B hemoperfusion, therapeutic plasma exchange, septic shock

P-071
A Pilot Survey of Polymyxin B Hemoperfusion in Septic Shock Patients
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Background: There are many ways to describe the mechanisms underlying septic shock. The presence of endotoxin has been well established to induce systemic inflammatory response in Gram-negative infection. Polymyxin B membrane membranes (PMX-HP; Toraymyxin; Toray Industries, Tokyo, Japan) using an extra-corporeal device has been developed and is currently largely used in patients with severe sepsis worldwide. However, the clinical benefit of Toraymyxin remains unclear, and Toraymyxin filter is very expensive compared to other septic shock treatment modalities. Thus, Toraymyxin is not widely used in Korea. We share our experience with Toraymyxin in the treatment of patients with severe sepsis.
Population and Methods: From Jan 2014 to Dec 2017, 26 cases of severe sepsis were treated with Toraymyxin. Their data were retrospectively collected from electronic medical records. The primary outcome was defined as 30-day mortality.
Results: We analyzed the data according to the results of blood culture; the survival rate was 33.3% (5/15) in the group with Gram-negative bacteria before use. The survival rate was 18.1% (2/11) in the group not identified or identified with Gram-positive bacteria, but there was no statistically significant difference (p=0.345). When analyzed according to the infectious agent, if the infection was treatable, abdominal surgery showed a survival rate of 37.5% (3/8); other infection cases showed a mortality rate of 22.2% (18.4), but no statistically significant difference (p=0.361).
Conclusions: Toraymyxin may be effective in the identification of Gram-negative bacteria and the surgical treatment of peritoneal infection. Further studies are needed to select the appropriate patient group.
Key word: Toraymyxin, Polymyxin, Sepsis
P-072
Successful Management of Carbapenemase Producing Enterobacteriaceae Outbreak in Intensive Care Unit

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Backgrounds: CPE (Carbapenemase producing Enterobacteriaceae) is one of the most problem of resistant pathogen nowadays and is globally becoming endemic in the hospital and healthcare facilities. Especially, caregivers of ICU (intensive care unit) should be more concerned about CPE outbreak because of decreased host defense and extremely limited options of antibiotic choice. We presented localized CPE outbreak in ICU and the method of its management and prevention of further spread of pathogen.

Methods: We found two CPE-colonized patients in respiratory tract. Moreover, one patient after 1 day and seven patients after 8 days were detected as CPE-colonizer by active surveillance of rectal swab culture. Cohorting, restriction of ICU admission, preemptive contact precaution of new patients, and environmental culture surveillance was done.

Results: All patient had history of carbapenem usage and long-term stay in hospital or healthcare facilities more than 20 days. Most of pathogens were KPC (Klebsiella pneumoniae carbapenemase)-producing Klebsiella pneumoniae but 2 were Enterobacter species. In environmental culture, one bedside computer monitor, and one intravenous infusion pump were contaminated by CPE. During 3 weeks of outbreak period, no more CPE-colonizer was found in active surveillance culture.

Conclusion: ICU patients having risk factors of CPE colonization should be carefully searched and managed by enhancing contact precaution, manpower and environmental hygiene.

Key words: Carbapenem-Resistant Enterobacteriaceae, Intensive Care Units

P-073
Estimating unrecognized in-ICU days of TB patients without isolation – A nationwide study

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Backgrounds: The aim of the study is to estimate the unrecognized in-ICU days of TB patients without isolation in South Korea, using national health insurance claim data.

Methods: Total patients who had claim data of drug susceptibility test for TB during 2014–2016, which means culture-proven tuberculosis were included. Among them, patients with admission records of ICU during infectious periods were selected, and their in-ICU days were calculated after subtracting periods of isolation. Infectious periods were defined according to the CDC’s guideline for contact investigation. The first day of infectious periods was simply defined as 3 months before doctor’s suspicion of TB in patients who received the prescription for respiratory medications, which means he had respiratory symptoms, and 1 month before doctor’s suspicion without prescription records of respiratory medications. The last day of infectious periods was defined as a day before the time point of first prescription of anti TB medications.

Results: From 2014 to 2016, 1282 cases were identified as having ICU care records during their infectious periods. Among them, 1174 cases had records of staying ICU for at least one day without isolation. Total sum of in-ICU days without isolation were 18,584 person-days during 3 years. Among the 1174 cases of unrecognized in-ICU TB patients, 374 cases underwent bronchoscopy, and 56 cases had records of laryngoscopy during their infectious periods. There were 201 cases of endotracheal intubation, 19 cases of cardiopulmonary resuscitation, 602 cases of nebulizer treatment, 63 cases of high flow nasal cannula oxygen therapy, and 350 cases of mechanical ventilation during infectious periods in ICU

Conclusions: The burden of nosocomial transmission of TB in ICU is still substantial in South Korea.

Key words: ICU, Tuberculosis, Infection

P-074
Scrub typhus with rhombencephalitis, transverse myelitis, and polyneuropathy

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Scrub typhus is a febrile illness caused by Orientia tsutsugamushi bacteria. It is endemic to Korea. The disease is characterized by fever, headache, myalgia, cough, suffused conjunctiva and gastrointestinal symptoms. The disease is characterized by focal or disseminated vasculitis and perivasculitis which may involve the lungs, heart, liver, spleen and central nervous system(CNS). The overall histological picture of scrub typhus in the central nervous system is best described as a meningoencephalitis. The occurrence of various neurological manifestations in scrub typhus has been well documented in literature, but a pa-
A 44-yr-old man presented with fever, chills, generalized rash in september 2017. He developed weakness of both lower legs, confusion, dysarthria. On examination, there was a eschar on the left hip area. The examination of the nervous system revealed flaccid quadriplegia and right central type facial palsy. All deep tendon reflexes and superficial abdominal reflex were absent. Plantar reflexes were mute. The touch, pain, temperature along with position and vibration sensations were markedly decreased below the neck. Cerebrospinal fluid (CSF) examination showed pleocytosis (white blood cell 180/ul). serum tsutsugamushi IgM antibody was > 1:1520. Magnetic resonance imaging (MRI) of spine revealed altered signal intensity involving brainstem, and spinal cord in region of C2-L2 suggestive of LETM. Nerve conduction study showed polyneuropathy. It is valuable to report that scrub typhus could involve such a extensive neurologic system involvement.

Key words: Tsutsugamushi infection, scrub typhus, rhombencephalitis

**Effects of Ulinastatin on Vasospasm following Spontaneous Subarachnoid Hemorrhage**

**Kum Whang, Jiwoong Oh**

Wonju Severance Christian Hospital

**Objective:** The pathological mechanism of vasospasm is not yet fully understood, however, numerous literatures have unrevealed and explained the various components in triggering the propagations of vasospasm such as Tumor Necrosis Factor-α, Interleukin-6, Interleukin-1β, Nitric Oxide and so on, some of which were reported that can be regulated by ulinastatin. Thus, we attempted to investigate the role of ulinastatin in vasospasm following Spontaneous subarachnoid hemorrhage (S-SAH).

**Methods:** We retrospectively studied 94 S-SAH patients who treated with endovascular embolization in our hospital from March, 2010 to March,2014. All patients were evaluated with transcranial doppler (TCD) during 2 weeks from admission. We classified these 94 patients into two groups based on the use of ulinastatin, then analyzed them with the following factors: gender, age, initial Glasgow coma scale (GCS), Glasgow outcome score (GOS), hemispheric index ratio, Fisher grade, intensive care unit (ICU) stay period, mean velocity of TCD.

**Results:** Of the 94 S-SAH patients, ulinastatin was injected intravenously to 26 patients (27.7%) while the remaining 68 patients (72.3%) were not used. Lindegaard ratio of ulinastatin used group is 2.33, but 3.08 in non-used group. Mean velocity on TCD is 82.69±33.08 cm/s in ulinastatin used group, 92.46±35.43 cm/s in non-used group. But the difference showed no statistical significance (p=0.5337).

**Conclusion:** Our data suggests that the use of the ulinastatin could be helpful for protection from vasospasm following S-SAH.

Key words: Spontaneous subarachnoid hemorrhage, Cerebral vasospasm, Ulinastatin

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**Table 1.** Demographic characteristic between Ulinastatin used group and non-used group

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ulinastatin</th>
<th>Non-use (n=68)</th>
<th>Use (n=26)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>51.8±12.1</td>
<td>56.3±12.18</td>
<td>0.0865</td>
<td></td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>31:37</td>
<td>6:20</td>
<td>0.0457</td>
<td></td>
</tr>
<tr>
<td>Fisher grade, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grade (4)</td>
<td>10(14.71%)</td>
<td>10(38.46%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grade (3)</td>
<td>43(63.24%)</td>
<td>13(50%)</td>
<td>0.0195</td>
<td></td>
</tr>
<tr>
<td>grade (2)</td>
<td>14(20.59%)</td>
<td>3(11.54%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grade (1)</td>
<td>1(1.47%)</td>
<td>0(0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial GCS (median)</td>
<td>14</td>
<td>13</td>
<td>0.0382</td>
<td></td>
</tr>
<tr>
<td>M: Male, F: Female</td>
<td>GCS: Glasgow coma scale, Chi-square, Mantel-Haenszel Chi-Square, Wilcoxon Two-Sample Test was use for statistical analysis (p&lt;0.05)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.** Variables between Ulinastatin used group and non-used group

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ulinastatin</th>
<th>Non-use (n=68)</th>
<th>Use (n=26)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value of MCA on TCD (cm/sec)</td>
<td>92.46±35.43</td>
<td>87.69±33.08</td>
<td>0.5537</td>
<td></td>
</tr>
<tr>
<td>Lindegaard ratio</td>
<td>3.08±1.39</td>
<td>2.33±0.88</td>
<td>0.0026</td>
<td></td>
</tr>
<tr>
<td>Lindegaard ratio ≥3</td>
<td>29(42.65%)</td>
<td>4(15.38%)</td>
<td>0.0132</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Good (GCS ≥4)</td>
<td>57(83.82%)</td>
<td>1661.54%</td>
<td>0.0203</td>
</tr>
<tr>
<td>Poor (GCS ≤3)</td>
<td>11(16.18%)</td>
<td>10(38.46%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU period</td>
<td>12.07±11.06</td>
<td>21.84±23.81</td>
<td>0.0170</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3.** Variables between Ulinastatin used group and non-used group (Fisher grade ≥3)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Ulinastatin</th>
<th>Non-use (n=23)</th>
<th>Use (n=23)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value of MCA on TCD (cm/sec)</td>
<td>95.33±37.44</td>
<td>87.67±34.52</td>
<td>0.392</td>
<td></td>
</tr>
<tr>
<td>Lindegaard ratio</td>
<td>3.19±1.48</td>
<td>2.32±0.92</td>
<td>0.0111</td>
<td></td>
</tr>
<tr>
<td>Lindegaard ratio ≥3</td>
<td>27(47.28%)</td>
<td>4(17.49%)</td>
<td>0.0200</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Good (GCS ≥4)</td>
<td>42(72.99%)</td>
<td>1256.59%</td>
<td>0.0427</td>
</tr>
<tr>
<td>Poor (GCS ≤3)</td>
<td>11(20.79%)</td>
<td>10(43.49%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU period</td>
<td>13.83±11.84</td>
<td>23.74±24.72</td>
<td>0.078</td>
<td></td>
</tr>
</tbody>
</table>

MCA: middle cerebral artery; TCD: Transcranial Doppler; GOS: Glasgow Out-come Scale; Statistical significance based on Mantel-Haenszel Chi-Square and chi-square test (p<0.05)
The factor associated with familial consent about organ donation in brain death

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**Background:** Despite various attempts to expand the donor pool, the difference between organ supply and organ demand continues. The number of individuals registering as donors and familial refusal to grant consent are notable limitations on the availability of organs for transplantation. Like most nations, familial refusal is an important factor that limits the number of organ donations. This research was intended to investigate the factors that influence successful organ donation and familial consent after brain death, and find the way resulting increased familial consent.

**Methods:** Medical records and data regarding 125 organ donation counseling with the families of brain death between January 2014 and December 2017 at a single tertiary medical center were retrospectively reviewed. We used the Chi-square test to identify the independent demographic variables associated with successful organ donation.

**Results:** The successful donation rate was 53.6% (67/125). The deceased age at the time of death (40 to 59 years, p = 0.042), the number of offspring (0 or 3, p = 0.029) and the cause of death (cardiac arrest and suicidal attempt, p = 0.005) were associated with familial consent. No significant associations were found between the deceased sex, family provider, occupation, education level, religion and the time to be considered brain dead.

In subgroup analysis of whom had operation for the cerebral lesion, familial consent rate tend to decrease as a number of operation increase, but it did not show statistical significance (p=0.147). Marriage state of deceased was failed to show statistical significance (p=0.073).

**Conclusion:** Family’s consent to donate was significantly associated with age at the time of death, the number of offspring and the cause of death. Consideration of the demographic factors of deceased will help to make a strategy of success familial donor conversation, leading increase of organ donation.

**Key words:** brain death, familial consent, organ donation
**P-077**

**Temporal Lobe Involvement in Japanese Encephalitis: Case report**

Ho Geol Woo, Moon-Ku Han*

Seoul National University Bundang Hospital

**Introduction:** Japanese encephalitis (JE) is a mosquito-borne flaviviral encephalitis that remains a major neurologic deficit. Usually, lesion of MR imaging and CT findings of JE have been described as bilateral thalamic, substantia nigra, basal ganglia, brain stem, cerebellum, cerebral cortical, and white matter lesions whereas temporal lobe involvement is characteristically seen in Herpes simplex encephalitis (HSE). Here, we report a case with temporal lobe involvement in Japanese encephalitis.

**Case:** A 75-year-old woman was presented with drowsy mentality and generalized tonic clonic seizure. Upon examination at the emergency department (ED), Glasgow coma scale was E4V1M1, and neck stiffness and Kernig’s sign were detected. Initial brain MR imaging only revealed an abnormal T2 hyperintensity and swelling in right medial temporal lobe. A lumbar puncture and cerebrospinal fluid (CSF) study was performed, revealing that the open pressure was 29 cmH2O, with a clear appearance. The CSF routine analysis showed a red blood cell count of 0/μL and white blood cell count of 6/uL. The CSF glucose level was 74 mg/dL, and the protein level was 96.2 mg/dL. At first, herpes simplex virus (HSV) encephalitis was suspected, and antiviral treatment and antiepileptic drug was given immediately. Eight days later, the patient developed semicoma mentality and flaccid paralysis in all limbs. Electroencephalography showed nearly continuous slow activity and was concluded to have severe diffuse cerebral dysfunction. The CSF HSV antibody test for both IgG and IgM was negative. Follow up brain MR imaging showed additionally increased extent of abnormal T2 hyperintensity and swelling in right anterior temporal lobe, insular area, right thalamus, left medial temporal lobe. Unfortunately, the patient expired 17 days after the admission was made. JE was finally diagnosed through the detection of JEV IgM antibody in both serum and CSF at 3 days after expire.

**Key words:** Japanese encephalitis, Temporal Lobe Involvement, Herpes simplex encephalitis

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**P-078**

**The blood pressure variation is related to hemorrhagic transformation after recanalization in stroke**

Hae-Bong Jeong, Tae Jung Kim, Soo-Hyun Park, Sang-Bae Ko*

Department of Critical Care Neurology, Seoul National University Hospital

**Introduction:** Elevated Blood pressure (BP) is known to be related to hemorrhagic transformation (HT) after ischemic stroke. However, the effect of BP variation on the HT remains unclear, especially in patients with successful recanalization after mechanical thrombectomy. Therefore, we investigated the relationship between BP and HT after mechanical thrombectomy following ischemic stroke.

**Methods:** A consecutive 211 patients with acute ischemic stroke and successful recanalization (TICI 2b or TICI 3) from three centers were included for the analysis between January 2013 and May 2017. The information on BP was obtained over the first 24 hours using various parameters including mean, maximum (max), minimum (min), difference between max and min (max-min), standard deviation (SD), coefficient of variation (CV), and successive variations (SV) for systolic, diastolic BP, and mean BP. We defined major HT as a parenchymal hematoma type 2 (PH2).

**Result:** Among the included patients (age, 67.2; and male. 56.9%), 23 patients (10.9%) developed major HT over the first 24 hours after successful recanalization. Systolic BP max-min (61.2 mmHg vs. 44.2 mmHg, P = 0.034) and diastolic BP max-min (35.8 mmHg vs. 27.2 mmHg, P = 0.025) were significantly increased in patients with major HT. In addition, systolic BP max-min was significantly associated with symptomatic HT (n=19, 9.0%, P = 0.045). After adjusting for confounders, systolic BP max-min and diastolic BP max-min were independently associated with major HT (systolic BP max-min Odds ratio, 1.03; 95% confidence interval, 1.01-1.05, diastolic BP max-min Odds ratio, 1.04; 95% confidence interval, 1.01-1.09).

**Conclusions:** Our results demonstrated that absolute change of BP over the first 24 hours was associated with major and symptomatic HT after successful mechanical thrombectomy after acute ischemic stroke. This suggests that maintaining stable BP is an important factor in possibly preventing major HT after successful recanalization.

**Key words:** Blood pressure variation, hemorrhagic transformation, mechanical thrombectomy
P-079

Premorbid malnutrition is associated with the risk of infection in patients with ischemic stroke

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Department of Critical Care Neurology, Seoul National University Hospital

**Background:** Infection is a common complication in the acute phase after ischemic stroke. Furthermore, malnutrition is associated with unfavorable outcome in patients with stroke. Therefore, we investigated that premorbid undernutrition identified by objective and quantitative method, Nutritional Risk Index (NRI) was related to the risk of infection after ischemic stroke.

**Methods:** A consecutive 852 patients who were admitted within 7 days after ischemic stroke onset between October 2010 and October 2015 were included. We assessed initial nutritional status using NRI, and NRI formula as follows: NRI = (1.519 × serum albumin, g/dL) + (41.7 × present weight/ideal body weight (kg)). The patients were categorized into three groups on the basis of NRI [No risk (NRI >97.5), Moderate risk (NRI 83.5-97.5), and Severe risk (NRI <83.5)]. We compared the clinical characteristics and NRI according to the presence of infection.

**Results:** Among the included patients (mean age, 67.7 years, male, 60.6%), 85 (10.0%) patients experienced infection during hospitalization. The proportion of lower NRI patients (Moderate risk and Severe risk) was significantly greater in the infection group (45.9% vs. 17.9% and 10.6% vs. 2.7%, P <0.001). Moreover, higher NRI patients were less likely to be admitted to the intensive care unit (P = 0.004). A multivariate analysis revealed that lower NRI groups had a higher risk of infection [Odds ratio (95% confidence interval); Moderate risk 3.98 (1.95 - 8.13); Severe risk 4.21 (1.10 - 16.14), P for trend = 0.001].

**Conclusion:** Our study demonstrated that lower NRIs predicted infection complications and severe infection after ischemic stroke. This suggests that assessment of nutrition depletion could be a useful predictor and a modifiable risk factor for infection following stroke.

**Key words:** Nutritional Risk Index, Premorbid malnutrition, post stroke infection

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P-080

High neutrophil to lymphocyte ratio increased the risk of stroke—associated pneumonia

Tae Jung Kim, Hae-Bong Jeong, Soo-Hyun Park, Sang-Bae Ko*

Department of Critical Care Neurology, Seoul National University Hospital

**Background and Purpose:** Although there are a variety of risk factors and predictive models of stroke-associated pneumonia (SAP), more objective and easily accessible markers are still needed. In this study, evaluate the relationship between the neutrophil to lymphocyte ratio (NLR) and SAP in acute ischemic stroke patients.

**Methods:** We assessed 1,317 consecutive acute ischemic stroke patients. SAP was defined according to the modified Centers for Disease Control and Prevention criteria. The severity of pneumonia was rated using scores from the Pneumonia Severity Index (PSI), the quick Sequential Organ Failure Assessment (qSOFA), and the Acute Physiology and Chronic Health Evaluation (APACHE) II. The NLR was calculated after dividing absolute neutrophil counts over absolute lymphocyte counts.

**Results:** Among the total patients, SAP occurred in 112 (9.0%) patients. Using a multivariate analysis, NLR [adjusted OR = 1.55; 95% confidence interval, 1.14-2.10, P = 0.005] remained significant after adjusting confounders. Age, atrial fibrillation, previous stroke history, initial National Institutes of Health Stroke Scale score, and high-sensitivity C-reactive protein were also significant, independent of NLR. NLR was higher in severe pneumonia groups when we assessed it by all PSI (P < 0.001), qSOFA (P < 0.001), and APACHE II scores (P = 0.004). Furthermore, patients who had SAP showed worse clinical outcomes both during hospitalization and after discharge.

**Conclusions:** We demonstrated that a higher NLR predicted SAP in acute ischemic stroke patients. The NLR would help to select high-risk patients in time and provide clues for further studies about preventive antibiotic therapy.

**Key words:** High neutrophil to lymphocyte ratio, pneumonia, stroke
**P-081**

**A case of E. coli meningitis with Disseminated Strongyloidiasis**

Han-Bin Lee, Sang-Beom Jeon*

Department of Neurology, Asan Medical Center, University of Ulsan College of medicine

**Introduction:** Strongyloidiasis is an infectious disease caused by Strongyloides stercoralis. We report a case of a pancreatic cancer patient who had E. coli meningitis in association with disseminated strongyloidiasis.

**Case presentation:** A 55-year-old man, with history of pancreatic cancer, presented to ER with diarrhea. Strongyloidiasis was diagnosed by the presence of filariform larvae of S. stercoralis in the sputum. One month after admission, the patient presented with stupor mentality and fever. A lumbar puncture showed leukocytes 50400/uL, protein levels 1099.3 mg/dL and glucose 2mg/dL. A CSF culture showed extended spectrum β-lactamase producing E. coli.

**Conclusion:** E. coli meningitis is an infrequent condition and associated with disseminated strongyloidiasis. In patients with disseminated strongyloidiasis presenting neurologic symptoms, G(-) CNS infection should have been considered in the differential diagnosis. However, disseminated strongyloidiasis has a poor prognosis.

**Key words:**

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**P-082**

**A case of chronic inflammatory polyneuropathy with bulbar palsy**

Jeong Su Kim, Yu Yong Shin, Sang Beom Kim*

Kyung Hee University Hospital at Gangdong

**Introduction:** Respiratory paralysis and ventilatory failure is rare in CIDP.

**Case presentation:** A 69-year-old female presented with weakness and paresthesia of all extremities. Initial NCS suggested sensorimotor axonal polyneuropathy. CSF study showed elevated protein level but normal cell count. Anti-ganglioside and paraneoplastic antibodies study were negative. In the diagnosis of A-CIDP, she was administered immunoglobulin and high dose steroid intravenously. After treatment, her motor power of upper extremities was restored progressively. During the next 3 months, she developed expectoration difficulty. Tracheostomy was done for proper respiratory care.

**Conclusion:** We report a patient of CIDP presenting with bulbar palsy and respiratory difficulty. Respiratory failure in CIDP is exceptional and its early recognition may prevent significant morbidity and mortality. Our case suggested the possibility of CIDP progressing to bulbar palsy with consideration of cranial nerve involvement.

**Key words:** CIDP, bulbar, axonal

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**P-083**

**The status of enteral nutritional supplementation in acute poisoned patients treating with atropine**

Eun Jung Park*, Younggi Min

Ajou University Hospital

**Background:** Organophosphate and carbamate poisoning is common and have diverse symptoms. Muscarinic signs are one of them and include salivation, defecation, urination, miosis, bronchorrhea and bronchospasm. To treat muscarinic symptoms, atropine which is a competitive antagonist at muscarinic receptors is used. Enteral nutritional feeding is recommended in critically ill patients and has beneficial effect with improved outcomes. However, usage of atropine precludes the enteral feeding as large doses of atropine prolong gastrointestinal (GI) transit time and decrease GI tone. Here, we investigated the status and the effect of enteral nutritional supplementation in acute poisoned patients receiving antidote therapy with atropine.

**Methods:** Retrospective observational study was conducted in one intensive care unit (ICU) of a university hospital. From 2010 to 2017, patients admitted with organophosphate or carbamate poisoning were seventy-seven.

**Results:** 36 patients treated with atropine received enteral nutritional supplementation. 8 patients (22.2%) of the included patients received enteral feed with atropine administration. The most common reason not to feed with atropine administration was the concern of prolonged GI transit time (15, 53.6%). GI problems including ileus, GI bleeding and pancreatitis and severe shock were the other reasons. There was no sign of feeding intolerance in the patients with atropine administration. There was no newly developed pneumonia after enteral feed. Comparing patients with atropine administration and those without atropine administration, duration of mechanical ventilation (p=0.746), ICU stay (p=0.951) and hospital stay (p=0.790) were similar.

**Conclusion:** In patients with administration of atropine, enteral nutritional supplementation is less common because of the concern of prolonged GI transit time. Feeding intolerance and pneumonia was not found in in the patients with atropine administration.

**Key words:** atropine, enteral, nutrition
P-084

Nutrition and critical care in very elderly patients 90 years of age or older

Sei Won Kim*
Division of Pulmonology and Critical Care Medicine, Department of Internal Medicine, Daejeon St. Mary’s Hospital

Background: The number of elderly patients admitted to ICU is increasing due to life extension and development of medical service. It is also well known that malnutrition is associated with high morbidity, mortality and other treatment outcomes. However, there are few reports with very elderly patients who admitted to the ICU.

Methods: We retrospectively reviewed the clinical data and nutritional support team records of 114 patients ≥ 90 y of age who admitted to ICU in Daejeon St. Mary’s Hospital from July 2014 to December 2017. The nutritional parameters and clinical factors related to survival were collected and analyzed.

Results: Mean age was 92.9±2.6 and 43.0% was male. About 30% of patients were from nursing home or long-term care hospitals and 87.7% of patients admitted via ER. About 90% of patients have nutrition problem (more than mild malnutrition) and mean BMI was 19.1±3.7. The percentage of enteral nutrition (EN), parenteral nutrition (PN), EN+PN at the time of nutrition assessment were 37.7%, 37.7%, and 17.5%, respectively. Survival rate was 64.9% and median length of hospital stay was 20.0 days. After multiple logistics regression, use of vasoressor, do not resuscitate (DNR), nutritional status and albumin level remained as a significant index.

Conclusion: From our results, nutritional status also remains an important factor for survival in very elderly patients who admitted to ICU. Although nutritional assessment and support for these patients have several limitations and difficulties, clinicians should pay more attention.

Key words: elderly, nutritional status, survival, critical care

P-085

Delayed cerebral air embolism with patent subcutaneous tract after central venous catheter removal

Seok Jeong Yang*, Sung Kyun Park
Ulsan University Hospital

Background: Central Venous Catheter (CVC) removal is a common procedure in hospital. Occasionally, some serious complications could occur after CVC removal and one of them is air embolism. We report a case of delayed cerebral and pulmonary air embolism with patent fibrin tract as venous air entry after CVC removal.

Case Presentation: A 29 year-old male patient underwent an emergent right hemicolectomy for ascending colon mesenteric avulsion due to motorcycle accident. Post-operatively he progressed well and CVC was removed on postoperative day 10 for preparing discharge. The catheter was removed following standard performance but the exist site covered with gauze. Three hours later after removal, he complained right arm weakness then suddenly became unresponsive with eyeball deviation for several minutes and recovered soon. Brain CT revealed there are some air embolisms on left hemisphere and he was moved to intensive care unit (ICU) (Fig 1.). In the ICU, he was alert but felt intermittent dyspnea with grade IV motor weakness on right upper extremity. His systolic blood pressure was about 80mmHg and oxygen saturation was about 90% on pulse oximetry even though high flow oxygen therapy. Nine hours later after CVC removal, we checked chest computer tomography and there was obvious air from subcutaneous tract to superior vena cava suggesting continuous air inflow (Fig 2). So, we compressed this patent tract and sealed the exit site with airtight dressing. Then his vital sign, oxygen saturation was normalized and he fully recovered without any sequela.

Discussion: Even short-term use of CVC, it can make fibrin tract as continuous air entry causing potentially fatal air embolism. It is a preventable hospital-acquired disaster if physician follows standard practice with air tight dressing strictly.

Key words: air embolism, central catheter removal
**P-086**

**Change in age distribution of critically ill patients in an aging society**

**Song-I Lee*, Chae-Man Lim**

Asan medical center

**Introduction:** The life expectancy of the Korean population increased from 62.3 years in 1970 to 82.4 years in 2016. Old age is associated with high prevalence of chronic disease as well as increased rate of hospitalization and intensive care. We aimed to investigate the changes in patient age distribution in an intensive care unit (ICU).

**Methods:** We retrospectively reviewed 51,758 patients aged $\geq 18$ years admitted to the medical ICU or coronary care unit at Asan Medical Center from January 2000 to December 2017. Patients were divided into four groups based on their age: $< 60$, $60 - 69$, $70 - 79$, $\geq 80$. Mortality, primary diagnosis, duration of ICU stay and hospital stay were compared among the groups.

**Results:** Over the past 18 years, the number of patients aged $< 60$ had decreased from 47.6% to 34.7%. While those aged $70 - 79$ increased from 17.1% to 25.4%, and those aged $\geq 80$ increased from 4.9% to 12.1%. Duration of ICU stay was $4.5 \pm 13.9$ days in patients aged $< 60$, but was $5.8 \pm 16.6$ days in those aged $70 - 79$ and $7.0 \pm 14.5$ days in those aged $\geq 80$. Duration of hospital stay was $17.3 \pm 42.1$ days in patients aged $< 60$, but $21.5 \pm 42.7$ days in patients aged $\geq 80$. When compared to those aged $< 60$, mortality odds ratio of those aged $70 - 79$ and $\geq 80$ were $1.234$ (95% Confidence Interval(CI): 1.153 - 1.320, $p<0.001$) and $1.852$ (95% CI: 1.688 - 2.033, $p<0.001$), retrospectively. As for first diagnoses according to age, respiratory diseases increased with age as well (9.2% to 21.1%).

**Conclusions:** The proportion of elderly ICU patients aged $\geq 70$ had significantly increased in the past 18 years, and the duration of ICU/hospital stay, and mortality were positively correlated with age.

**Key words:** Epidemiology, Aging, ICU

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**P-087**

**Common Carotid Artery–Trachea Fistula: Incidental Migration of Clavicle Fixation Kirschner Wire**

**HeungBum Lee*, SeungYong Park, Jae Seok Jeong, Sang Min Han, Yeong Hun Choe, So Ri Kim, Seoung Ju Park, Yong Chul Lee**

Department of Internal Medicine, Chonbuk National University Medical School

Hemoptysis has many causes. Migration and erosion of hardware into the chest have very rarely been associated with hemoptysis. Orthopedic metallic pins and wires are frequently used for the fixation of fractures and dislocations. Given the number of wires used in orthopedic surgery, iatrogenic injury due to orthopedic wire migration is a rare disease entity. And also, migration of shoulder pins to the adjacent space has been reported several times in the past. A 79-year-old man visited our emergency room because of abrupt hemoptysis. He was heavy smoker and his medical history had hypertension, gout, benign prostate hypertrophy, and previous pneumonia, and at 9 months before admission, the patient had a fracture of the right clavicle which was treated by the insertion of Kirschner wires for fixation. Chest roentgenograms, chest computed tomographic scans, and bronchoscopy revealed that previous Kirschner wires had migrated through Right common carotid artery and into the upper trachea. Immediate right deck incision was performed to remove the wire. The K-wire was seen covered with thin fibrous tissue and granulation. Fortunately, his postoperative course was relatively well. We report an unusual case of hemoptysis due to penetration of the common carotid artery and trachea by a migrating Kirschner wire.

**Key words:**

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**P-088**

**A Case Report: Successful MARS therapy for acute liver failure in pregnancy**

**Heung Bum Lee*, Yoon Sung Seo, Seung Yong Park, Jae Seok Jeong, Yeong Hun Choe, So Ri Kim, Seoung Ju Park, Yong Chul Lee**

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Acute liver failure (ALF) in pregnancy is a rare life-threatening condition most frequently appearing in the third trimester of pregnancy or the early postpartum period. ALF specific to pregnancy including pre-eclampsia, associated with hemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome, acute fatty liver of pregnancy, and hepatic infarction result in increased maternal and fetal mortality if not recognized and acted on early. Treatment of acute fatty liver of pregnancy is a combination of maternal stabilization and prompt delivery of the fetus, regardless of gestational age. In severe cases, mostly when diagnosis has been delayed, there may be many more days of illness requiring maximal supportive management in an intensive care unit, including mechanical ventilation because of coma, dialysis for acute renal failure, parenteral nutrition because of associated pancreatitis, or even surgery to treat bleeding from a preceding cesarean section.
The molecular adsorbents recirculating system (MARS) is the best known blood detoxification system based on albumin dialysis indicated for patients with acute liver failure and acute on chronic liver failure. MARS is usually used for the treatment of drug overdoses, poisoning and hepatic encephalopathy and has also been studied in acute liver failure. Herein, we report an interesting case of 28-year-old female patient (Pregnancy 36wks + 1) that pregnancy induced acute liver failure, DIC, and AKI was improved by best supportive care after MARS.

**Key words:**

**P-089**

Does a history of Rapid Response Team (RRT) activation mean a high risk when re-admitted?

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**Background:** For the patient's safety, it is important to recognize and monitor patients at risk earlier. In this study, we investigated whether previous Rapid Response Team (RRT) activation could be used as an alert signal in patients readmitted.

**Methods:** We analyzed retrospectively the observational cohort of patients who were managed in RRT at a single center in Asan Medical Center from Jan. 2009 to Dec. 2016. Among these periods, a total of 10,565 patients were activated by RRT, and 3,306 patients who were re-admitted were included in this study. We divided the patients into two groups, re-activated group (N = 620) and non-re-activated group (N = 2686), and compared baseline characteristics between two groups. And we performed subgroup analysis depending on the underlying disease

**Results:** RRT activation rate of in-hospitalized patients per year ranged in 1.5% to 2% but the activation rate increased to 18.8% in patients with a history of previous RRT activation. The incidence of the hematologic disease, chronic lung disease, and cerebrovascular disease as comorbidity (p<0.001) was significantly higher in the reactivation group. Hospital mortality (52% vs. 13.6%) and hospital stay (50 vs. 39 days) showed significant differences between the re-activation group and the non-re-activation group (p<0.001). In the subgroup analysis by underlying disease, hospital mortality of re-active group was also higher in all subgroups (58% vs. 17% in solid tumor group and chronic lung disease group, 64% vs. 16% in hematologic disease group).

**Conclusion:** This study suggests that patients who have a history of RRT activation could be needed a close monitoring when they are re-admitted.

**Key words:** Rapid Response Team, RRT, re-admit, reactivation, high risk

**P-090**

Withdraw

**P-091**

Use of intravenous treprostinil in neonatal pulmonary arterial hypertension after cardiac surgery

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**Background:** Pulmonary arterial hypertension (PAH) is a life-threatening condition in neonatal cardiac surgery for congenital heart disease. While parenteral prostacyclin therapy improves survival in patients with severe PAH, there is a paucity of data on neonatal intravenous prostacyclin use for pulmonary arterial hypertension after cardiac surgery for congenital heart disease. Our aim was to assess the efficacy, safety, and tolerability of intravenous treprostinil treatment in neonatal PAH patients after cardiac surgery for congenital heart disease.

**Methods:** Medical records were reviewed retrospectively. Four patients were treated with intravenous treprostinil in a single institution. Indications for intravenous treprostinil therapy were clinical worsening and/or echocardiographic progression of PAH in spite of inhaled nitric oxide and inhaled prostacyclin during postoperative period of cardiac surgery. The pre-operative diagnosis were ventricular septal defect with Edward syndrome (n=1), pulmonary atresia/intact ventricular septum with severe congenital tricuspid regurgitation (n=1), severe obstructive total anomalous pulmonary venous return (n=1), and functional single ventricle (n=1).

**Results:** Following treprostinil initiation, clinical status improved or did not change in three of four patients. One patient died early during treprostinil therapy after extracorporeal membrane oxygenator (ECMO) support. The final dose in treated patients was between 30 and 40 ng/kg/min and the duration of treprostinil was from 2 days to 15 days. Aside from thrombocytopenia, other severe side effects were not observed. ECMO weaning was done in two patients. Ventilator support was needed in one patient.

**Conclusions:** Intravenous treprostinil could be a feasible and well-tolerated therapy in neonate with severe PAH after cardiac surgery.

**Key words:** pulmonary hypertension, treprostinil, neonate
P-092
Delayed awakening after low dose remifentanil infusion for maintenance of General Anesthesia

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Introduction: Opioids could be the causes of delayed awakening after general anesthesia. Remifentanil did not cause an delayed awakening in the usual dose. We report a case of delayed awakening with a low dose during short operation.

Case Report: A 53-year-old woman (height 160 cm, body weight 68.3 kg) was scheduled for vitrectomy. Anesthesia was induced with propofol, remifentanil 0.1 mcg / kg / min and rocuronium and was maintained with desflurane and remifentanil 0.01 to 0.05 mcg / kg / min. The total amount of remifentanil was 200 mcg. After extubation, she still showed comatous state. Neurological ex amination showed suspected drug intoxication. Naloxone was administered, she moved more actively and showed a verbal response. After 5 hour in the recovery room, she transferred to the room and did not remember that event.

Conclusion: Remifentanil is a widely used because of short duration. Nevertheless, we confirmed that delayed awakening can be possible with remifentanil.

Key words: delayed awakening, remifentanil, sedation

P-093
Errors in medicine prescription identified by dedicated pharmacist in ICU

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Introduction: Although drug prescription for patients in intensive care unit (ICU) should be careful, there are always possibility of error in prescription. Multidisciplinary team approach can be helpful to identify and reduce the errors and improve clinical outcomes.

Methods: We performed multidisciplinary round consisting of full-time intensivist, attending physician, nurse and ICU dedicated pharmacist every Wednesday since March of 2016. ICU dedicated pharmacist reviewed overall dosage, usage of prescribed medicine and target drug monitoring results before every round. We retrospectively reviewed the incidence and type of prescription errors in ICU.

Results: From 1 January 2018 to 28 February 2018, 9 times of multidisciplinary rounding was performed in 4 ICUs in Dong-A University Hospital and drug prescription of 520 patients were reviewed by pharmacist (57.8 patients at each rounding). Totally 55 prescription errors were identified. Inappropriate renal/hepatic dose reduction was most common errors (24 cases, 43.6%) and followed by drug efficacy overlap (14 cases, 25.5%), inappropriate administration of drug (7 cases, 12.7%), inappropriate dose/usage (5 cases, 9.1%), possible drug-drug interaction (2 cases, 3.6%), and others (3 cases, 5.5%). Inappropriate renal/hepatic dose reduction was most common in meropenem (11 cases, 39.3%) followed by piperacillin/tazobactam (7 cases, 25.0%), quinolones (5 cases, 17.9%). Drug efficacy overlap was identified mostly in H2-blocker and proton pump inhibitor. All errors were collect at every multidisciplinary.

Conclusion: Medicine prescription in ICU should be carefully reviewed to minimize the possible prescription errors and multidisciplinary team approach with dedicated ICU pharmacist can identify and reduce those errors.

Key words: Prescription, error, pharmacist, intensive care unit

P-094
Factors Predicting the Need of Intensive Care in Patients Who Were Admitted Pulmonary Tuberculosis

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National medical center

In pulmonary tuberculosis(TB) patients, acute respiratory distress syndrome is a common cause in the intensive care unit(ICU). Although high mortality in pulmonary TB patients requiring ICU care are well known, factors influencing ICU care from admitted general ward initially is not well known. A nested case-control study was performed among TB patients recruited from July 2013 to march 2017 in National Medical Center in Korea. Cases included 32 patients with pulmonary TB admitted ICU from general ward and 55 controls were selected from 623 TB patients requiring hospital admission after matching with age, sex, and radiologic findings of extent of tuberculosis. Based on the information related to the risk of ICU admission, odds ratio(OR) for ICU admission was tested by conditional logistic regression. Among 1:2 matched cases and controls, the range of age, sex and the extent of TB on radiologic findings were distributed even. Patients who were referred to ICU have lasted their symptoms longer before admission to hospital. The level of serum albumin(g/dL) and hemoglobin(g/dL) were lower in patients who had needed intensive care (p<0.001 and p=0.005, respectively). The higher level of C-reactive protein(CRP) was found in patients who were referred to ICU (p=0.005). The most common cause
for ICU referral was respiratory failure (87.5%). Patients who were referred to ICU stayed in ICU for mean duration of 22.5 days (min-Max 1.0-82.0 days). After adjusting the duration of symptom persistence before admission, BMI, and the level of hemoglobin and CRP, which were also satisfied to be put into the multivariate analysis, the level of albumin was found to significantly predict for the risk of intensive care within the admission period (Q1 albumin < 2.0; OR 17.78, 95% CI 13.32-240.32, and 2.0-3.0; OR 7.05, 95% CI 0.70-71.08, p for trend 0.04, respectively). This study showed the level of albumin at admission was crucial to predict the admission of ICU care in patients.

**Key words:** pulmonary tuberculosis, intensive care

**P-095**

A comparative clinical study on usability, safety, and medical staff satisfaction of MV2000-MT

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**Background:** Although there are commercialized domestic mechanical ventilators, most ventilators used in domestic hospitals are imported products. In the present study, we aimed to demonstrate that MV2000-MT (SU: M2)® (MV, MEK-ICS, Paju, Korea), a domestic ventilator, is not inferior in terms of usability, safety, and medical staff satisfaction as compared to Hamilton G5 (G5, Hamilton Medical AG, Ruzins, Switzerland), one of the most widely used ventilators.

**Methods:** This is a non-randomized, prospective, open-label registry study. A total of 54 patients, applied MV (group M) or G5 (group H), were enrolled. Usability was evaluated by the following factors: (A) the number of alarm errors; (B) replacement requirement of breathing circuit; (C) replacement requirement of a right-angle connector; (D) the elapsed time of the ventilator weaning (Fig. 1). For safety evaluation, the number of ventilator replacements due to malfunction of the ventilator was evaluated. Items for medical staff satisfaction survey were as follows: (A) the number of MV and G5 uses; (B) hardware and software assessment: the 16-item scoring on a 5-point Likert scale (1 point: very poor - 5 points: very good, Fig. 2.).

**Results:** In the usability evaluation, the replacement requirement of the right-angle connector was lower in group M than in group H (p = 0.021), but the other parts were not different between the two groups (Fig. 1). In terms of safety, the number of replacements due to a malfunction of the ventilator was 3 in group M and none in group H (p = 0.089). Overall, the medical staff satisfaction score of G5 was higher than that of MV (Fig. 2).

**Conclusion:** The usability of MV2000-MT(SU:M2)® is comparable to that of Hamilton G5. It is necessary to compensate for the drawbacks of MV2000-MT(SU:M2)® safety. Medical staff satisfaction was higher in Hamilton G5 than in MV2000MT (SU: M2) ®. However, this difference can be due to the difference in the number of uses.

**Key words:** Ventilators, Mechanical ventilators

**P-096**

Stuck suction catheter in endotracheal tube

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**Introduction:** Endotracheal tube (ETT) suction is frequently required for adequate ventilation. However, serious complications can occur. In this case, suction catheter was stuck in ETT and split by forcible pulling.

**Case Presentation:** An 89-year-old female was scheduled for ophthalmic surgery. The patient was intubated with 6.5 mm oral-preformed ETT. At the end of surgery, after ETT suction with a 12 Fr suction catheter, it was found that the catheter got stuck in ETT. The catheter was
pulled forcefully, but it was split into two parts. The patient was ventilated with distal part of catheter remaining in ETT. As the catheter could be reached by Kelly forceps, it was removed after normal saline injection.

**Conclusion:** Once suction catheter lodges in ETT, it can be dangerous because the catheter may interrupt ventilation. The catheter should be lubricated and appropriate catheter size must be selected. It is important to avoid forcible pulling when the catheter got stuck in ETT.

**Key words:** endotracheal tube, suction

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**P-097**

**Tension pneumocephalus induced by high-flow nasal cannula oxygen therapy**

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High-flow nasal cannula oxygen therapy (HFOT) recently has been used widely in adults. However, data regarding its possible adverse effect is lacking. We describe a patient who developed tension pneumocephalus during HFOT. A 69-years old male with a history of traumatic intracranial, epidural and subdural hemorrhage developed aspiration pneumonia and then underwent mechanical ventilation (MV). He received HFOT to prevent postextubation respiratory failure. After 48 hours, his mental status was deteriorated to stuporous. His brain CT revealed a newly appeared large amount of pneumocephalus with midline shifting and nearly collapse of left ventricle with Mount Fuji sign indicative of a tension pneumocephalus. His facial bone CT suggested his previous skull base fractures at right frontal and ethmoidal sinus. These implied that a positive pressure was applied into intracranial space via these openings. He recovered after stopping HFOT. This is the first adult case report ever known.

**Key words:** High-flow nasal cannula, tension pneumocephalus, adverse effect

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**P-098**

**The result of applying Advanced Practice Nurse (APN) driven Post-Tracheostomy Care**

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**Background:** The tracheostomy is known to increase sputum, induce coughing, interfere with swallowing and vocalization, and may cause complications in 65% of patients with long-term retention. If airway related problems such as unplanned decannulation or dislodgement are not treated early, it can cause life-threatening emergencies thereby it requires safe management. If it is possible, patient status should be assessed periodically and early decannulation is preferred. The purpose of this study is to introduce the results of the application and development of post-tracheostomy care including the airway management, weaning from mechanical ventilator and decannulation by an APN with knowledge and skills in tracheostomized patient management.

**Methods:** The post-tracheostomy care and the cycle of visit were drafted by considering based on the related literature and the clinical situation, and the final program are confirmed by modification after the preliminary investigation. From March 1, 2016 to December 31, 2017 the retrospective studies were performed on patient with APN driven post-tracheostomy care and transferred to general ward from ICU of Samsung Medical Cancer Center.

**Results:** A total of 118 patients were enrolled, the mean age was 65 ± 12.4 years. 16 (13.5%) were transferred to general ward with mechanical ventilator, and 14 weaning it off. 41 were screened for a capping by APN. 27 passed the capping trial, and 26 were decannulated successfully by APN. It was 27 days from the tracheostomy to decannulation (17-44). No significant adverse event was reported. 14 patients (22.0%) failing assessment were decannulated by an otolaryngologist and it took 56 days (35-90) to decannulation after tracheotomy.

**Conclusions:** APN driven post-tracheostomy care in general ward is safe and it can establish efficient airway management system.

**Key words:** APN, tracheostomized patient, Post-Tracheostomy Care
Elevating Mean Platelet Volume Can Predict Prognosis of Severe Pneumonia

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Background: Severe pneumonia has high morbidity and mortality. Mean platelet volume (MPV) is a marker of platelet size and activity. Subjects with a higher MPV have larger platelets that are metabolically and enzymatically more active than smaller platelets. We hypothesized that the MPV reflect platelet activity, and is associated with impaired host response, and may predict mortality in patients with severe pneumonia.

Methods: This is a retrospective study conducted using data from an operational database of patients admitted to the medical ICU of the Kyung Hee University Hospital between October 2010 and October 2017. Patients were included if they were admitted or transferred to the ICU with pneumonia. We analysis the relationship between MPV and 28days mortality. MPV were determined using an automated hematology analyzer (ADVIA 2120 and ADVIA 2120i, Siemens, Munich, Germany).

Results: Among the original study population of 235 patients with pneumonia, the mean age of the patients was 70.5 ± 12.8 years, the mean APACHE II score was 19.6 ± 6.5. The mortality was 34%. The rANOVA revealed a significantly higher rate of MPV over the first 4 days in non-survivors than in survivors. In multivariate analysis, ΔMPVday1–2, ΔMPVday1–3, ΔMPVday1–4, ΔMPVday1–Discharge, and ΔPlateletday1–Discharge still remained significant independent risk factors of in-hospital mortality, even after adjusting for age, APACHE II score, etc. For in-hospital mortality, the optimal ΔMPV were > 0.9 (fL) (P = 0.0201, P < 0.0001), > 0.8 (fL) (P = 0.000857), and > 1.3 (fL) (P < 0.0001) at days 2 and 3, day 4, and discharge, respectively.

Conclusion: Rising MPV during hospitalization might be used as a prognostic marker of mortality in patients with severe pneumonia.

Key words: MPV, pneumonia, mortality

Pancreaticopleural fistula with pleural effusion: Successfully treated with a pancreatic duct stent

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Introduction: Pleural effusion due to pancreaticopleural fistula (PPF) is a rare complication of chronic pancreatitis. Pleural effusion results from fistulous tract between the pancreas and the pleural cavity.

Case presentation: A 42-years-old male, an alcoholic, presented with a month history of dyspnea. A chest radiography showed a massive left-sided pleural effusion (Fig 1). Pleural fluid study revealed an exudate with elevated amylase levels. Abdominal CT scan showed calcification and dilatation of main pancreatic duct and fluid collections around the pancreas. PPF was considered as a cause of pleural effusion. Endoscopic retrograde cholangiopancreatography (ERCP) (Fig 2) revealed luminal obstruction at head portion of pancreatic duct with upstream dilatation. After placing stent in the pancreatic duct, pleural effusion was improved gradually.

Conclusion: PPF should be considered in the differential diagnosis of pleural effusions. ERCP is useful in diagnosis and treatment of PPF.

Key words: Pancreaticopleural fistula, Pleural effusion, Endoscopic retrograde cholangiopancreatography
P–101

Possible preventability of general ward CPR with or without medical emergency team

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**Background:** Reducing possibly preventable cardiopulmonary resuscitation (CPR) in general ward is one of most important purpose of medical emergency team (MET). To assess efficacy and validity of part-time medical emergency team, we investigated the possible preventability of CPR in general ward.

**Methods:** MET in Dong-A university hospital (DIRECT) made a start in April, 2017. MED intensivist and regular nurse regularly reviewed all CPRs occurred in general ward every two week. All CPRs were determined to be ‘unpreventable’ and ‘possibly preventable’. We compared the preventability of CPRs during MET on-duty time and off-duty time.

**Results:** From 1st of April 2017 to 31th of December 2017, 52 cases of CPR were occurred in general ward; 10 cases (19.2%) during MET duty time and 42 cases(80.8%) during MET off-duty time. 30 cases (57.7%) were determined to be unpreventable and 22 cases (42.53%) possibly preventable.

Expected cause of CPR was cardiac cause in 23 (44.2%) patients, and followed by respiratory in 15 (28.8%), advanced malignant disease in 5 (9.6%), septic 4 (7.7%) and other causes in 5 (9.6%) patients. In-hospital death was identified in 44 patients (84.6%).

Possible preventability between on-duty and off-duty of MET did not show significant difference. However, rate of return of spontaneous circulation (ROSC) was significantly higher in CPRs during on-duty time.

**Conclusion:** In part-time MET hospital, CPR during on-duty exhibited higher ROSC rate with no significant difference of possible preventability.

**Key words:** rapid response system, medical emergency team, cardiopulmonary resuscitation

<table>
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<tr>
<th>On-Duty (n=10)</th>
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<tr>
<td>In-Hospital Death</td>
<td>8 (80.0%)</td>
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P–102

Noninvasive brain temperature monitoring

So Mi Shin, Gil Joon Suh*, Kyung Su Kim, Yoon Sun Jung, Taegyun Kim

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**Introduction:** Therapeutic hypothermia after return of spontaneous circulation is the only way to reduce brain injury in post-cardiac arrest. During TH, esophageal, rectal or pulmonary artery temperature monitoring has been usually used as an alternative to reflect true brain temperature monitoring. However, temperature difference may occur depending on the measurement site. Moreover, injury to the brain results in thermopooling, which can cause greater temperature differences. However, direct brain temperature monitoring is too invasive to be applied clinically. Our aims were to compare invasive brain temperature with pulmonary artery, esophageal, rectal temperatures during TH in swine cardiac arrest or sham animals, and to develop a novel noninvasive brain temperature monitoring device.

**Methods:** TH was provided to the swine CPR group or sham group. TH of 33°C ± 0.5°C was given for 8 hours and then slowly rewarmed over a 16 hours period. Invasive brain temperature using Hemadex system, pulmonary artery temperature, esophageal temperature and rectal temperatures were measured, respectively, and compared between the CPR and sham groups. Non-invasive brain temperature using double sensor device was also measured. Following K-value adjustment, validation study was done to compare invasive and noninvasive core brain temperature.

**Results:** The difference between invasive brain temperature and rectal temperature was significant in the CPR group compared to the sham group (0.21°C in CPR vs 0.07 sham, p = 0.005). However, the difference between invasive brain temperature and pulmonary artery or esophageal temperature showed no significance between the two groups.

Noninvasive brain temperature monitoring were also well correlated with invasive brain temperature monitoring (correlation coefficient 0.9914).

**Conclusion:** We developed a novel noninvasive brain temperature monitoring device which can be used as an alternative for the invasive brain temperature monitoring.

**Key words:** brain temperature monitoring, PCAS, TTM
Floor Nurses’ Perception of the Rapid Response Team

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Background: The rapid response team (RRT) identifies and evaluates patients at risk for cardiac arrest and intervenes early on to reduce preventable deaths. The RRT can be activated when patients meet the calling criteria. Delayed activation of RRT is equivalent to not activating it, which can lead to preventable deaths. Since floor nurses mostly activate the RRT, their perception of the service is critical for optimal RRT utilization. This study evaluated the perception of RRT among floor nurses.

Methods: The perception of RRT was measured among floor nurses who worked at a university-affiliated academic hospital in the metropolitan city, using the Australian Commission on Safety and Quality in Health Care’s Rapid Response System Staff Knowledge and Satisfaction Survey, which is a 24-item questionnaire. Participants were asked to rate each item on a 5-point scale from strongly disagree to strongly agree. Responses were classified into two categories, negative perception from strongly disagree to uncertain and positive one from agree to strongly agree.

Result: Of the 419 nurses who responded, most felt that the emergency assistance from the RRT was effective (90%) and helped manage unwell patients (88.8%). Few nurses reported that they avoided calling the RRT due to fear of criticism that the patient was not sufficiently unwell (33%). Despite the hospital RRT calling criteria, 91.5% of nurses reported that they would call the covering doctor first, and 72.8% indicated that they would activate the RRT if they were unable to contact the covering doctor.

Conclusions: Floor nurses valued the RRT service and its potential benefits. The major barrier to calling the RRT was the approach of first calling the covering doctors, rather than the fear of being criticized for calling the RRT service. Another barrier was the lack of understanding of the RRT calling criteria. Therefore, ongoing education should be provided to promote activation of RRT by floor nurses.

Key words: Rapid response team, Nurses, Perception

Association of gender on mortality in critically ill patients: A retrospective cohort study

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Background: Previous studies on the effects of gender on mortality of critically ill patients showed conflicting results. Hormonal difference between male and female may play a beneficial role in critically ill condition, but additional survival benefit in premenopausal women is unclear.

Methods: We conducted a retrospective study with all admissions in medical intensive care unit (ICU) of Asan Medical Center from July 1,
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2006 to June 30, 2015. The mortality rate and duration of ICU admission were analyzed according to gender.

**Results:** Among 7,972 admissions, the male sex occupied two-thirds of all hospitalizations. Male patients were older, had higher sequential organ failure assessment (SOFA) score at admission, and longer duration of admission in both ICU and hospital than female patients. The female was more likely to survive than the male, 66.5% vs. 62.5%, respectively. This trend was consistent when the mortality rate was adjusted for age and SOFA score at admission; Odds ratio 1.139 for male sex with confidence interval 1.011 ~ 1.283. In patients older than 55 years, gender difference in mortality disappeared. In patients younger than 55 years, gender difference in mortality was not statistically significant difference (p = 0.282). Cut-off point of bilirubin to albumin ratio for mortality in ICU patients was 0.31. In multivariate analysis, the higher APACHEII score (Hazard ratio [HR] 1.05; 95% CI 1.03-1.06, p < 0.001) and bilirubin to albumin ratio (HR 1.65; 95% CI 1.23-2.20, p = 0.001) were associated with mortality of critically ill patients requiring the ICU management.

**Conclusions:** The higher bilirubin to albumin ratio was related with the increased mortality in critically ill patients. Therefore, clinicians might predict a poor prognosis through the initial assessment of bilirubin to albumin ratio.

**Key words:** hyperbilirubinemia, albumins, critical illness

**P-106**

Post-Traumatic Stress Disorder Symptoms and Quality of Life of Patients with Coronary Artery Disease

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**Background:** Patients with coronary artery disease (CAD) experience post-traumatic stress disorder (PTSD) symptoms due to sudden chest pain, unexpected invasive procedure, or surgery, which threatens life. The purpose of this study was to investigate the degree of PTSD symptoms and to analyze the factors affecting quality of life (QOL) of patients with CAD.

**Methods:** The subjects of this study were 135 patients who were diagnosed with CAD and registered in the cardiovascular center at a University Hospital in Busan, Korea. Data collection was conducted from July 1, 2016 to September 30, 2016, using structured questionnaires. PTSD symptoms were measured using the 17 items of Posttraumatic Diagnostic Scale (PDS), and QOL was measured by SF-36. Data were analyzed by descriptive statistics, t-test, ANOVA, Pearson correlation of coefficient, and hierarchical regression analysis of SPSS / WIN 23.0 program.

**Results:** The mean PDS score of the study subjects was 7.33 ± 6.00. Specifically, the mean score of re-experiencing was 1.88 ± 2.65, avoidance was 2.36 ± 2.72, and arousal was 3.08 ± 2.53. Among 135 subjects, 20.7% were classified as moderate risk group and 3.7% as high risk group for PTSD. PTSD symptoms were significantly higher in subjects who were diagnosed with CAD for less than 6 months (t = 26.02, p < .001). The norm based score of the physical component of health-related QOL was 42.43 ± 9.17, and for the mental component was 49.64 ± 11.29. The physical component of health-related QOL was significantly

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**Key words:** Gender, Female, Mortality

**P-105**

The bilirubin to albumin ratio in critically ill patients: related with increased mortality

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**Background:** Hyperbilirubinemia and low albumin is common in critically ill patients and related with poor outcomes. To aim of this study is to evaluate the association between the bilirubin to albumin ratio and prognosis in critically ill patients.

**Methods:** In retrospective study of 731 patients who were admitted in medical intensive care unit (MICU) at a tertiary-care center from July, 1, 2015 to September, 30, 2017, we analyzed the bilirubin to albumin ratio at initial admission to MICU, including their clinical characteristics and other examinations. The primary end point was the 28-day mortality after MICU admission.

**Results:** The overall survival of MICU patients was 69.1%. In univariate analysis, APACHE II score (p < 0.001), SOFA score (p < 0.001), SAPSII score (p < 0.001), C-reactive protein (p = 0.015), and bilirubin to albumin ratio (p < 0.001) were related to mortality of ICU patients. The ROC curves for the mortality of ICU patients between bilirubin to albumin ratio and APACHEII score, the area under curve (AUC) was 0.628 and 0.662, were not statistically significant difference (p = 0.282). Cut-off point of bilirubin to albumin ratio for mortality in ICU patients was 0.31. In multivariate analysis, the higher APACHEII score (Hazard ratio [HR] 1.05; 95% CI 1.03-1.06, p < 0.001) and bilirubin to albumin ratio (HR 1.65; 95% CI 1.23-2.20, p = 0.001) were associated with mortality of critically ill patients requiring the ICU management.

**Conclusions:** The mortality rate was higher in male than female patients who stayed in ICU. There was no difference in mortality between male and female in critically ill patients younger than 55 years, but the mortality rate was higher in male than female in patients older than 55 years.

**Key words:** hyperbilirubinemia, albumins, critical illness

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**P-106**

Post-Traumatic Stress Disorder Symptoms and Quality of Life of Patients with Coronary Artery Disease

Seung-Ah Lee¹, Jiyeon Kang²*
¹ Dong-A university medical center¹, Department of nursing, Dong-A university²

**Background:** Patients with coronary artery disease (CAD) experience post-traumatic stress disorder (PTSD) symptoms due to sudden chest pain, unexpected invasive procedure, or surgery, which threatens life. The purpose of this study was to investigate the degree of PTSD symptoms and to analyze the factors affecting quality of life (QOL) of patients with CAD.

**Methods:** The subjects of this study were 135 patients who were diagnosed with CAD and registered in the cardiovascular center at a University Hospital in Busan, Korea. Data collection was conducted from July 1, 2016 to September 30, 2016, using structured questionnaires. PTSD symptoms were measured using the 17 items of Posttraumatic Diagnostic Scale (PDS), and QOL was measured by SF-36. Data were analyzed by descriptive statistics, t-test, ANOVA, Pearson correlation of coefficient, and hierarchical regression analysis of SPSS / WIN 23.0 program.

**Results:** The mean PDS score of the study subjects was 7.33 ± 6.00. Specifically, the mean score of re-experiencing was 1.88 ± 2.65, avoidance was 2.36 ± 2.72, and arousal was 3.08 ± 2.53. Among 135 subjects, 20.7% were classified as moderate risk group and 3.7% as high risk group for PTSD. PTSD symptoms were significantly higher in subjects who were diagnosed with CAD for less than 6 months (t = 26.02, p < .001). The norm based score of the physical component of health-related QOL was 42.43 ± 9.17, and for the mental component was 49.64 ± 11.29. The physical component of health-related QOL was significantly

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**Key words:** hyperbilirubinemia, albumins, critical illness
influenced by gender (\( \beta = -0.26, p = .003 \)) and recurrence of CAD (\( \beta = 0.21, p = .011 \)). These two variables accounted for 12.1% of physical component of health-related QOL variation. Adding the PDS score to these variables increased the explanatory power to 22.4%. Body mass index of the subject was a significant influencing variable for mental component of health-related QOL (\( \beta = 0.21, p = .011 \)), and explained 10.8% of dependent variable variation. When PDS score was added, important factor related to survival. Further studies are needed to improve the survival of the RRT system.

**Key words:** coronary artery disease, post-traumatic stress disorder, quality of life

**P-107**

**Clinical characteristics and comparison of before and after 24-hour system rapid response team**

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**Background:** To ensure patient safety and improvements in the quality of hospital care, rapid response teams (RRTs) have been implemented in many countries, including Korea. However, it is not easy to be fully implemented with the 24-hour operating system because of the many problems. This study was designed to investigate the changes after change from the part-time system to the 24-hour system.

**Methods:** In Seoul St. Mary’s hospital, St. Mary’s Advanced Life Support Team (SALT) was implemented part-time system in June 2013. After May 2016, SALT was changed to a 24-hour system. We retrospectively reviewed the RRT activation record from June 2013 to October 2017.

**Results:** There were 369 RRT activation cases. There were 6.31 cases per month in part-time system and there were 8.87 cases per month in 24-hours system. After the implementation of the 24-hour system, RRT activation cases were increased statistically significantly (p<0.015). The median response time was 8.0 minutes (interquartile range, 4.0–11.0) in part-time system, 9.0 minutes (interquartile range, 7.0–11.0) in 24-hour system, respectively (p=0.626). There was no significant difference in the survival rate of 24-hours after RRT activation. Also, there was no significant difference in overall hospital survival after RRT activation. This is because the malignancy ratio was increased after 24-hour system (p=0.013).

**Conclusions:** RRT activation cases were increased. Malignancy was the

**Key words:** Medical emergency team, Rapid response team, Survival, Operating hours,

**P-108**

**Early diagnosis of ICUAW and muscle fatigue assessment in LT recipient: A Case Report**

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**Introduction:** ICUAW can occur after liver transplantation (LT), and monitoring muscle condition during rehabilitation may be helpful.

**Case Presentation:** A 47-year-old man with liver cirrhosis developed limb weakness after LT. The MRC sum score was measured as 36 points after 2 weeks of LT. Direct muscle stimulation was performed on the right TA and the N/M ratio was 0.96, which indicates critical illness myopathy (fig1). Fatigue analysis using surface EMG (sEMG) was performed four times after LT. The MVC tended to increase during rehabilitation, while %MVC tended to decrease, indicating that the muscle strength was increased. Fatigue index gradually decreased, which means that muscle endurance was improved with the strength (fig2).

**Conclusion:** Muscle fatigue using sEMG can be evaluated during the rehabilitation to prevent damage to impaired muscle, and to control exercise intensity. Early diagnosis of ICUAW and evaluation of muscle fatigue will ensure a better prognosis for the patient.

**Key words:** ICUAW, sEMG, transplantation

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**Fig. 1 (A) Conventional NCS.** The CMAP amplitude of the right peroneal nerve decreased to 1.7mV, (B and C) DMS. The amplitude of neDCMAP was 4.8mV and dDCMAP was 4.8mV. The nerve/muscle ratio was 0.96.

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*Abbreviations: NCS, nerve conduction study, Sk, tibialis anterior EMG, direct muscle stimulation, CMAP, compound muscle action potentials, neDCMAP, nerve evoked CMAP; dDCMAP, direct muscle stimulation CMAP*
Acute cannulated vein thrombosis after continuous renal replacement therapy: Case series

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Department of Surgery, Kyungpook National University Hospital, Kyungpook National University, School of Medicine, Daegu, Republic of Korea

**Introduction:** Acute kidney injury (AKI) is often encountered in critically ill patients and may occur in up to 30 percent of such patients. Renal replacement therapy (RRT) is indispensable for these patients. Recently, continuous renal replacement therapy (CRRT) has been the preferred mode of RRT in critically ill patients. Although adequate anticoagulation is needed for a proper dialysis, frequently, anticoagulation is not available due to the risk of bleeding in patients with multiple trauma. As one of the catheter complications, the cannulated vein thrombosis (CVT) is a serious complication to be a potential source of pulmonary embolism. Nevertheless, there have been few reports of CVT after CRRT on trauma patients to date. Herein we introduce our experiences of CVT after CRRT in patients with multiple trauma.

**Case presentation:** CVT has been developed in two patients among the patients who underwent CRRT after multiple traumatic injuries in our hospital recently. Two patients underwent CRRT through the dual luminal catheter in femoral vein due to AKI. However, the anticoagulant could not be used in both patients during CRRT because of bleeding risk. CVT was incidentally diagnosed by a follow up contrast enhanced abdominal computed tomography (CT) scan. On diagnosis, there was no symptom in all patients. Anticoagulation was started immediately after diagnosis in two patients. CVT was completely resolved in follow up contrast enhanced CT in all patients and there was no abnormality in cannulated femoral vein.

**Conclusion:** CVT is not rare complication in the traumatic patients who are unable to use anticoagulation during CRRT. In these patients, more active efforts are needed to know whether CVT has occurred. The further study is needed to evaluate the prevalence, causes and risk factors of CVT after CRRT in patients with multiple trauma.

**Key words:** cannulated vein thrombosis, CRRT, anticoagulation
The 37th KSCCM Annual Congress and Asian Critical Care Conference 2018

This work was supported by the Korean Federation of Science and Technology Societies Grant funded by the Korean Government.
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- 신경계, 근육계, 심혈관계, 호흡계, 요장, 비강,계, 피부계의 여러 부위에 대한 임상적 효능을 입증받았다.
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Streptococcus agnorsus, Streptococcus constellatus, Streptococcus salivarius와 같은 균주군에 Bacteroides fragilis와 같은 균주군에

CUIT과 cIAI에서 입증된 임상적 효능
- 자석(서울대驹橋)는 cUTI의 복잡성 흡착성 감염의 입증된 임상적 효능을 입증받았다.
- CUIT과 cIAI에서 입증된 임상적 효능을 입증받았다.
- cUTI와 cIAI에서 입증된 임상적 효능을 입증받았다.

특종 연구 대상자 전단
- 자석(서울대驹橋)을 사용한 전단 방법을 입증받았다.
- cUTI와 cIAI의 전단 방법을 입증받았다.

자석(서울대驹橋)의 임상적 성과
- 자석(서울대驹橋)의 임상적 성과를 입증받았다.
- 자석(서울대驹橋)의 임상적 성과를 입증받았다.

Study Design
- 자석(서울대驹橋)의 임상적 성과를 입증받았다.
- 자석(서울대驹橋)의 임상적 성과를 입증받았다.

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- 자석(서울대驹橋)의 임상적 성과를 입증받았다.
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The incidence of exacerbations was 2.1% in the fluticasone group and 1.7% in the placebo group (p = 0.18).

^{2} Secondary objectives: efficacy vs concomitant fluticasone compared with concomitant fluticasone vs placebo

^{3} Tolerability vs concomitant fluticasone compared with concomitant fluticasone vs placebo

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1. An echinocandin (caspofungin: loading dose 70 mg, then 50 mg daily; micafungin: 100 mg daily; anidulafungin: loading dose 200 mg, then 100 mg daily) is recommended as initial therapy (strong recommendation; high-quality evidence).

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Portex® Blue Line Ultra® Suctionaid®
For easier tracheostomy maintenance

AIRwAy mANAGEmENT
• Rapid Onset & Rapid Offset
• Rapid Awakening & Recovery
• Reduce requirement of opioid antagonist
• Shorten the time to extubation in ICU patients

For the anaesthesia induction and sedation

울티안주®
(Remifentanil HCl)
진통과 진정효과를 한번에!

NEW
Dual Effect!
Medex®
dexmedetomidine hydrochloride

호흡 안정성 유지와 진정효과를 한번에!

최면진정제
메덱스® 주
(대성메데포미드산업)

Dual Effect!
진통과 진정효과를 한번에!
호흡 안정성 유지와 진정효과를 한번에!

MD
5 Vials
Medex® Inj.
dexmedetomidine hydrochloride

2mL × 5 Vials
ABL90 FLEX PLUS analyzer
19 critical parameters including crea/urea on 65 μL

A clever solution for acute care testing

Working with acute care testing for critically ill patients demands a clever POC solution. That’s exactly what you get from the ABL90 FLEX PLUS blood gas analyzer. This clever compact POC blood gas analyzer enables you to improve the clinical decision-making in your department and increase the quality of your patient care.

With the ABL90 FLEX PLUS analyzer you get lab quality test results on 19 critical parameters in only 35 seconds. Around the clock.

The ideal solution for faster and more accurate acute care testing!
Achieve full dilatation in one simple pass.
Bacterial Infections and Sepsis
Procalcitonin Testing

- Contributes to early diagnosis
  - Indicates infection severity
  - Reflects efficacy of initiated therapy
  - Comforts decision to stop antibiotic therapy
  - Allows reduction of antibiotic exposure and related side-effects
  - Optimizes patient management and resource allocation

References
2. Dandona P, J Clin Endocrinol Metab, 1994; 79: 1685-1698

Roche
한국로슈진단(주)
Central Support Center 080-939-1234
SINCE 1999

Mcube Technology is

Leading company for diagnosis and treatment of voiding dysfunction

3D Bladder Scanner CUBEScan™

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Extracorporeal Magnetic Stimulator

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Ever wanted a window to see inside your patients lungs?

The PulmoVista® 500 making ventilation visible
The PulmoVista® 500 uses Electrical Impedance Tomography (EIT) imaging to help optimise and individualise lung ventilation therapy by continuously and non-invasively monitoring the regional distribution of ventilation, and changes of end-expiratory lung volume, in real-time and at the bedside. This enables the clinician to assess the patient’s response before, during and after any interventions related to respiratory therapy.

TO FIND OUT MORE, VISIT WWW.DRAEGER.COM/PULMOVISTA

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Arrow®
EZ-IO®
Intraosseous Vascular Access System

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Omnidex Inj. (Dexmedetomidine HCl) for Satisfactory Solution.

- For Cooperative Sedation
- 삼망 (Delirium) 감소, 호흡억제 없는 Sedation
- 마취제와 진통제의 효과 연장
- 고통압, 번맥, 부정맥 환자에서 BP・HR 감소

경보제약
A clear view on infusion
Efficient information at a glance, INTELLIVENT® ADV gives you a unique, intuitive and efficient way to monitor the patient’s Heart-Lung Interaction. Information about the hemodynamic stability of the patient is displayed in a single window, providing a graphic representation of the current status.

IntelliCuff

More IntelliCuff® means more flexibility! IntelliCuff® allows for easier, more comfortable care, requiring less intervention. It operates in different modes, allowing the clinician to find suitable solutions for most critical situations. Ultrasound can achieve the same outcomes of traditional methods, in a non-invasive and traumatic cuff inflation adjustments. The system will display the cuff pressure relative to the average arterial pressure (Paw). The difference between the Paw (peak) and cuff pressure will be kept constant to provide a tight sealing cuff.

Optimal cuff pressure with IntelliCuff®

Over-Inflated cuff

Under-Inflated cuff

Hamilton Medical

HealthDyne
Leading the way in visualisation

Ambu® aScope™ 3, aScope™ Slim and aView™
GE Healthcare

CARESCAPE Monitor B650

The evolution of
Critical care:
supporting efficient and informed decisions.

In the Critical Care Unit, efficiency is paramount. You can’t afford to spend time piecing together incomplete information or tracking down vital patient data in multiple hard-to-reach systems. Your technology should support you by combining monitoring data streams with access to cardiac records and other relevant data to help you make the best care decisions.

The CARESCAPE™ Monitor B650 makes it fast and easy to access the vital patient details you need, right when and where you need them. At its foundation are GE’s clinical algorithms, widely recognized for their leading cardiac and ventilation assessment capabilities. In addition, the CARESCAPE Monitor B650 collects data from multiple systems and delivers it in an intuitive, integrated display that results in fewer repetitive tasks, faster access and quicker analysis. As a result, caregivers are armed with the decision support information required to deliver appropriate, expedient patient care.


Add spirometry loops and patient metabolics to assess patient readiness for weaning trials.

The user interface was designed by a global team of usability experts and clinicians to help make learning easy.
Servo Ventilator

MAQUET

Servo-ι  Servo-ς  Servo-air
i-STAT HANDHELD
An advanced, easy-to-use blood analyser that provides healthcare professionals with access to real time, lab-quality results within minutes rather than hours

Patient-side testing in four easy steps

**STEP 1**
Insert two or three drops of blood into the cartridge.

**STEP 2**
Slide cartridge into the analyser.

**STEP 3**
View results on the analyser screen within minutes.

**STEP 4**
Upload information wirelessly or through a docking station.

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New Perception of Video Laryngoscopy
Better Solution for Airway Management

True Color and High Resolution Image
Anti-fogging Disposable Blade Sheath
High Resolution Camera

Photo & Video Function
Double Clot Joint

Displayer
- Portable, lightweight, and cordless
- Tilt & Rotatable 2.5" LCD screen allows viewing from various positions
  - Front-and-rear rotation angle: 0° ~ 130°
  - Left-and-right rotation angle: 0° ~ 270°
- Worry-free long-lasting rechargeable lithium-ion battery
  - Charging time: <4hr, Working time: ~ 3hr
- Consistently clear view of vocal cords enables fast and safe intubation

TRS-C2
- Oxygen-supplied joint: to be used for antifogging and used under anaerobic environment
- Unique S-curved design: especially fit for upper airway exposed structure and tracheal intubation

TIC Flexible Videoscope
Make intubation easier, faster and safer
- 3.5" high resolution screen and clear image for airway structure
- Clinical use with human-machine interface and the functions of real time photograph, video and data access
- Different tube size: Diameter - 2.8mm, 3.8mm, 4.8mm, 5.2mm, 5.5mm
- Sputum suction, O₂ delivery and drug delivery
**ETCO2 모니터링 마스크 / 산소 마스크**

→ 안정적 산소 공급을 위한 특수 디자인 마스크

**cap-one 산소 마스크의 특수 디자인의 효과로 마스크 내 산소 확산이 균등하게 이루어집니다.**

**Oxygen targets**

<table>
<thead>
<tr>
<th>O₂ flow</th>
<th>YG-242T infant</th>
<th>YG-232T child</th>
<th>YG-272T/YG-282T adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>2L/min</td>
<td>60%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>4L/min</td>
<td>70%</td>
<td>50%</td>
<td>45%</td>
</tr>
<tr>
<td>6L/min</td>
<td>80%</td>
<td>60%</td>
<td>50%</td>
</tr>
</tbody>
</table>
TIVA Re injection

Remifentanil 1,2,5mg

✔️ 빠른 작동발현시간  ✔️ 수술 후 빠른 의식 회복  ✔️ 혈류역학적 안정성

※ 제품에 대한 자세한 내용은 제품설명서를 참고하시기 바랍니다.

References
1) TIVA with propofol/remifentanil compared to balanced anaesthesia with sevoflurane/fentanyl in gynaecological laparoscopic surgery, Anaesthesia 1999; 48:807-12.
Advancing the Delivery of Health Care.*
카테터의 개방성 증대, 효과적인 소독, 교환주기의 연장
MaxZero™는 Protection과 Practice를 향상시킵니다.

- Proven three-second disinfection
단단하게 밀폐되어 있는 connector의
표면은 라인으로 오염물질이 들어가는
것을 막아줍니다.

- Neutral clamping sequence
역류방지를 위해서 clamping을 할 필요가 없습니다.
MaxZero™ needless connector는 역류방지 기능을
통해 카테터로 혈액이 다시 들어오는 것을 차단합니다.

- Bacteria has nowhere to hide
약물의 주입시 약물경로를 눈으로 볼 수 있으며,
 이를 통해 잔여약물에 대한 flushing의 효율을
향상시킬 수 있습니다.

- Blood reflux prevention
MaxZero™ needless connector는 positive
pressure flushing나 clamping 없이 카테터
라인의 개방성을 유지시켜 줍니다.
Merittrans® DTXPlus®
Disposable Transducers Sets

KEY FEATURES

- **EasyVent™ Deadender**: minimizes risk of touch contamination during zeroing and priming.
- **Clear Housing**: allows for easy identification and flushing of air bubbles.
- **Flow Actuator**: provides stability to prevent accidental activation, safeguarding patient safety.
- **On/Off Switch**: confirms stopcock position at 45°/90° to reduce the risk of accidental air embolism.
- **Angled Drip Chamber Cannula**: reduces air bubble formation.
- **Robust Monitor Interface Connection**: prevents fluid penetration. Alignment arrows make connection quick and easy.

**GABARITH™ TESTED**
- Scientific test to ensure waveform accuracy of the entire system.
- Meets standard of Association for the Advancement of Medical Instrumentation (AAMI)

**R.O.S.E.®**
- Eliminates resonance overshoot via consistent damping through a fixed resistance.
- Works on pressure tubing between 36°-48°.

**M STOPCOCK**
- Selected sets include M stopcock for blood sampling.
- Fits any common blood sampling device.