The 22nd KSCCM-JSICM Joint Congress

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Collateral damage of COVID pandemic

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（KSCCM）

Collateral Damage of the COVID-19 epidemic on Mortality and Medical Utilization in Korea.

Young Sam Kim（Severance Hospital）

TBD

(JSICM)

Support Project for the Capital City 'Tokyo' during the Fifth Wave of COVID-19 in Japan

Jun Hamaguchi (Tokyo Metropolitan Tama Medical Center, ECMO Center)

In the summer of 2021, we experienced the fifth wave of COVID-19. An unprecedented number of newly infected patients occurred all over Japan, especially in Tokyo, where the number of patients far exceeded the medical capacity. As a result, the number of hospital beds that had been secured was exceeded, making it extremely difficult to deal with critically ill patients. Commissioned by the Ministry of Health, Labour and Welfare (MHLW), Japan ECMO net dispatched more than 30 intensive care physicians, especially experts in ventilatory management, from all over Japan to Tokyo.

The results of treatment of critically ill patients with COVID-19 in Japan are very good even in the world. This can be attributed to the fact that the number of patients has remained low compared to the rest of the world and the medical capacity taking care of critically ill patients have not collapsed. However, in the fifth wave, a large number of critically ill patients occurred, forcing medical institutions not accustomed to ventilatory management to treat them, and there were fears that this would lead to a decline in treatment outcomes. This project dispatched expert physicians to those medical institutions to teach and educate them about the know-how of treatment such as ventilatory management and prone positioning, with the primary objective of preventing a decline in treatment results. We conducted activities such as dispatching doctors and cooperating with inter-hospital ECMO transport for one month until the medical situation settled down, and then developed remote support using the web.

This project, which was responsible for the proper allocation of medical resources, played a role as a life saver for the treatment of critically ill patients in Tokyo. On the other hand, issues such as insurance and compensation were brought to light, and we will need to consider.

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Web-based family meetings

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（KSCCM）

TBD

Seung Young Oh（Seoul National University Hospital）

TBD

(JSICM)

Effect of web based meeting and direct patient visit on PICS-F in COVID-19 era

Mitsumasa Arai（St. Marianna University hospital）

The Emergency Medical Center of St. Marianna University hospital began treating COVID-19 patients in February 2020. According to data through the end of December 2021, 326 severely Ill patients were admitted and the total number of deaths reached 58. On February 13, 2020, the Japanese government issued the "Basic Policy for Countermeasures against Novel Coronavirus Infections" and stated the need to prevent infection in medical institutions and facilities for the elderly. Our hospital has also started to restrict family visitation to patients.

We were concerned that separated family members would be more susceptible to PICS-F symptoms such as anxiety disorders, depression, and post-traumatic stress disorder (PTSD). The various stresses that family members undergo may exacerbate their original physical conditions and chronic illnesses. They may be even threatened their economic and social status, making it difficult for them to reintegrate into society.

Although family visitations were conducted via video call using tablets, many staff members commented that face-to-face direct visitation was the best way for families to feel safe. In response to this situation, in April 2021, our hospital started direct visitation by family members, accompanied by experiental nurses, only for COVID-19 end-of-life care patients. A total of 9 direct family visitations have been conducted so far.

It is still uncertain which is more effective, video visitation or direct visitation. There is a lack of evidence focusing on PICS-F prevention strategies for families of COVID-19 patients.

In this presentation, we report the results of our study to describe the effectiveness of video visitation versus direct visitation by interviewing families who experienced bereavement, about their subsequent PICS-F symptoms, acceptance of bereavement, IADLs, and reintegration into society.

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Burnout of medical personnel

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（KSCCM）

Burnout in Korean ICU nurses

Gahee Shin（Severance Hospital, Pediaric ICU）

Burnout is an essential problem for critical care nurses because they are exposed to prolonged psychosocial stressors, including high level technique, great responsibilities and precise care in patient. In this presentation, it will review the current state of burnout in Korea ICU nurses, including the status due to the prolonged pandemic of the COVID-19 situation. Also it will demonstrate the factors causing the burnout syndrome in Korea ICU nurses and how it impacts to the individual, patients and organizations when nurses experience burnout. At the conclusion, as it is important to promote ICU nurses well-being, it will summarize how to manage burnout as individually and organizationally.

(JSICM)

Coping with medical personnel burnout; a chance for promoting occupational health and safety in healthcare.

Masayuki Ozaki（Department of Emergency and Critical Care Medicine, Komaki City Hospital)

The COVID-19 pandemic has accelerated burnout among medical professionals. Burnout is a syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment caused by stressors such as the risk of infection, permanent overwork, moral distress, time pressure, or conflicts with colleagues. Emotional exhaustion refers to feelings of being emotionally drained. Depersonalization is characterized by the development of dehumanized and cynical attitudes toward their job. Reduced personal accomplishment is seen as negative self-assessment and a feeling of poor performance at work. This syndrome negatively impacts employee performance and job satisfaction, resulting in leaving of medical personnel and a shortage of staff.

Coping strategies such as having a regular sleep, exercising, spending time with family, and engaging in recreation or hobbies, have been known to lower the risk of burnout. However, these coping strategies at the individual level are likely to have limited effectiveness, especially in a pandemic that has caused not only burnout also various occupational health problems.

In the Japanese medical industry, "safety" has been perceived to be the safety of patients. On the other hand, there has been little awareness of occupational health and safety in the healthcare industry. Some preventive movements exist for occupational health issues in Japan (i.e., reducing long working hours and preventing needlestick injuries). However, they have been taken separately because of the lack of awareness that all these are occupational health issues. Without awareness of the importance of health and safety in the workplace, we would not deal with occupational health issues, including burnout, effectively during catastrophic situations like pandemics.

Occupational health and safety for health workers consist of managing infectious risks, physical risks, and psychological risks. These risks are interrelated and affect the development of burnout. Work management, work environment management, personal health management, and education will reduce those risks. This systematic approach will improve the well-being of healthcare workers. Taking the opportunity of this pandemic to promote occupational health among healthcare workers will ultimately lead to a decrease in burnout.

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Excellent abstract

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1-1

Perioperative junctional ectopic tachycardia associated with congenital heartdisease: Risk factors and appropriate interventions

Gaku Izumi 1 , Atsuhito Takeda 1 , Hirokuni Yamazawa 1 , Nobuyasu Kato 2 , Hiroki Kato 2 ,
Tsuyoshi Tachibana 3 , Osamu Sagae 4 , Ryogo Yahagi 4 , Motoki Maeno 4 , Koji Hoshino 5 ,Hitoshi Saito 5
1 Department of Pediatrics, Faculty of Medicine and Graduate School of Medicine, Hokkaido University
2 Department of Cardiovascular and Thoracic Surgery, Faculty of Medicine and Graduate School of Medicine, Hokkaido University
3 Department of Cardiovascular surgery, Kanagawa Children's Medical Center
4 Division of Medical Engineering Center, Hokkaido University Hospital
5 Department of Anesthesiology and Critical Care Medicine, Faculty of Hokkaido University Hospital

Introduction
The risk factors and the appropriate interventions for perioperative junctional ectopic tachycardia (JET) in congenital heart disease (CHD) surgery have not been sufficiently investigated despite the severity of this complication. This study aimed to examine the risk factors and interventions for perioperative JET.
Methods
From 2013 to 2020, 1,062 surgeries for CHD (median patient age: 4.3 years, range: 0.0-53.0) with or without a cardiopulmonary bypass (CPB) were performed at Hokkaido University, Japan. We investigated the correlation between perioperative JET morbidity factors such as age, genetic background, CPB/aortic cross-clamp (ACC) time, use of inotropes and dexmedetomidine, STAT score, and laboratory indices. The efficacy of JET therapies including electrolytes arrangement, strengthening sedation, reduction of inotropes, hypothermia therapy, anti-arrhythmic drugs, temporary pacing, open chest, and cardiopulmonary support was also evaluated.
Results
Of the 1,062 patients, 86 (8.1%) developed JET. The 30-day mortality was significantly high in JET groups (7% vs. 0.8%). The independent risk factors for JET included heterotaxy syndrome [odds ratio (OR), 4.83; 95% confidence interval (CI), 2.18-10.07], ACC time exceeding 90 min (OR: 1.90; CI:1.27-2.39), and the use of 3 or more inotropes (OR: 4.11; CI: 3.02-5.60). The combination of anti-arrhythmic drugs and a temporary pacing was the most effective therapy for intractable JET.
Conclusions
Perioperative JET after CHD surgery remains a common cause of mortality. Inotrope use was a risk factor for developing JET overall surgery risk. In short ACC surgeries, heterotaxy syndrome could increase the risk of JET, which could develop even without inotrope use in long ACC surgeries. It is crucial not to delay the treatment in cases with unstable hemodynamics caused by this arrhythmia. It is recommended to reduce numbers not dose of inotropes.

1-2

Lipid emulsion inhibits late apoptosis induced by chloroquine toxicity in rat cardiomyoblasts via inhibition of ROS

Seong-Ho Ok, Seung Hyun Ahn, Soo Hee Lee, Gyujin Sim, and Ju-Tae Sohn

Department of Anesthesiology and Pain Medicine, Gyeongsang National University College of Medicine, Gyeongsang National University Hospital, Republic of Korea

Introduction: Recently, it was reported that chloroquine (CQ) and hydroxychloroquine (HCQ), which were used as alternative drugs to treat the coronavirus disease 2019, inhibited severe acute respiratory coronavirus 2 in in vitro experiments. However, further clinical studies have found that CQ and HCQ produced cardiac toxicity, leading to dangerous arrhythmia. Lipid emulsion (LE) has been reported to be effective in treating cardiovascular collapse induced by toxic doses of CQ and HCQ. Thus, this in vitro study examined the effect of LE (Lipofundin MCT/LCT) on cardiac toxicity induced by toxic doses of CQ in rat cardiomyoblasts.

Methods: The effects of LE (0.75%), CQ (10-4 M), and reactive oxygen species (ROS) scavenger (10-5 M mitotempo and 10-4 M N-acetylcysteine), alone or in combination, on the cell viability and migration, ROS production, and mitochondrial membrane potential (MMP) of H9c2 rat cardiomyoblasts were determined. The effects of LE and ROS scavenger on the CQ (10-4 M)-induced expression of cleaved caspase-3, cleaved caspase-8, and Bax were examined. The effects of LE and CQ, alone or in combination, on apoptosis (early and late), TUNEL-positive cells, malondialydehyde (MDA), sulfoxide dismutase (SOD), and catalase were also examined.

Results: LE, and ROS scavenger N-acetylcysteine and mitotempo attenuated the decreased cell viability and migration, increased ROS production, and decreased MMP induced by CQ. LE, mitotempo, and N-acetylcysteine inhibited the increased cleaved caspase-3 and Bax expression induced by CQ. LE inhibited the CQ-induced increase in the number of TUNEL-positive cells. Lipid emulsion attenuated the late apoptosis induced by CQ. LE inhibited the increased MDA induced by CQ and attenuated the decreased SOD and catalase induced by CQ.

Conclusions: Taken together, these results suggest that LE attenuates late apoptosis induced by toxic doses of CQ via the intrinsic apoptotic pathway, which is due to the reduction of mitochondrial ROS production.

1-3

Purkinje cell degeneration, demyelination, and synaptic impairment induced neurological deficits 3 weeks post heat exposure in a rodent model

Kazuyuki Miyamoto 1,2,3 , Hirokazu Ohtaki 2 , Motoyasu Nakamura 1,2 , Keisuke Suzuki 1,2 ,
Hiroki Yamaga 1,2 , Kaoru Yanagisawa 1,2 , Atsuo Maeda 1 , Masaharu Yagi 1 ,Kazuho Honda 2 , Kenji Dohi 1,2

1 Department of Emergency, Critical care and Disaster medicine, Showa University School of Medicine, Japan
2 Department of Anatomy, Showa University School of Medicine, Japan
3 Department of Emergency and Disaster Medicine, Showa University Yokohama Northan Hospital, Japan

Introduction: Global warming will increase the incidence of heatstroke in the near future. After heatstroke, patients are bedridden and exhibit some neurological symptoms (disorientation and vertigo), suggesting cerebellar damage. However, the potential long- term adverse outcomes are poorly understood. Therefore, we focused on the cerebellum after heatstroke in the present study. Methods: Male, C57/BL6J mice were divided int heatstroke (HS) and control (Con) groups. The HS mice were exposed to high ambient temperature (41° C) and relative humidity (>99.0%) for 1 h. Rotarod tests were performed 1, 3, 5, 7, and 9 weeks post-heat exposure (HE), and running time was compared between the Con and HS groups. The brains from the Con and HS were dissected at 1, 3, and 9 weeks post HE. Klüver–Barrera staining and calbindin immunostaining were performed, demyelination of medulla and the number of Purkinje cells in the Con and HS groups were compared. Moreover, Synaptophysin and postsynaptic density-95 (PSD95) immunostaining were performed to evaluate the Purkinje cell's synaptic patency. Results: Motor coordination disorder in HS significantly appeared 3 weeks post HE and gradually improved to some extent over time. Demyelination was detected at 1 and 3 weeks, and the Purkinje cell number significantly decreased at 1, 3, and 9 weeks post HE in HS group. The synaptophysin and PSD95 expression temporally decreased at 3 weeks and recovered 9 weeks post HE. Conclusion: Motor coordination loss occurred a few weeks after HE and recovered to some extent. Motor impairment was suggested to be caused by the Purkinje cell degeneration, transient demyelination, and synaptic impairment.

1-4

Real-World Effects of Continuous piperacillin-tazobactam infusion in critically ill patients with sepsis: A retrospective, single center study

Dong-gon Hyun 1 , Jarim Seo 2 , Jee Hwan Ahn 1 , Dong Kyu Oh 1 , Sang-Bum Hong 1 ,
Chae-Man Lim 1 , Younsuck Koh, Jin Won Huh 1

1 Department of Pulmonary and Critical Care Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea
2 Department of Pharmacy, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea

Introduction: Continuous infusion of beta-lactam antibiotics has emerged as an alternative for the treatment of sepsis because of the favorable pharmacokinetics of continuous infusion. This study aims to evaluate the survival benefits of continuous versus intermittent infusion of piperacillin-tazobactam in critically ill patients with sepsis.

Methods: We retrospectively conducted a single center study of continuous infusion versus intermittent infusion of piperacillin-tazobactam for adult patients who met the criteria of sepsis-3 and were treated at medical ICU within 48 hours after hospitalization between May 1, 2018 and April 30, 2020. The primary outcome was mortality at 28 days. Secondary outcomes included discharge alive from ICU at day 28, microbiologic response, and normalization of C-reactive protein (CRP) on day 7.

Results: A total of 157 patients (47 continuous group and 110 intermittent group) met the inclusion criteria for evaluation. There was no difference in mortality at 28 days: 12.8% and 27.3% in the continuous and intermittent groups ($p = 0.07$). After adjustment for potential covariables, patients in the continuous group showed a statistically significant decreased mortality at 28 days than those in the intermittent group (adjusted hazard ratio, 0.33; 95% confidence interval, 0.13-0.83; $p = 0.02$). However, discharge alive from ICU (subdistribution hazard ratio, 0.94; 95% confidence interval, 0.61-1.44; $p = 0.77$) was no significant association with continuous infusion. Although the rate of microbiologic response did not differ significantly between the two groups (27.7% versus 21.8%, $p = 0.54$), patients in the continuous group (8.5%) had a higher rate of normalization of CRP on day 7 than in the intermittent group (1.8%, $p = 0.04$).

Conclusions: In critically ill adult patients who met the criteria for sepsis-3, continuous infusion of piperacillin-tazobactam for treatment of sepsis may suggest a possible mortality benefit at 28 days than those with intermittent infusion.

1-5

Quantification of respiratory sounds by continuous monitoring system can be used to predict complications after extubation: A pilot study

Kazuya Kikutani, Shinichiro Ohshimo, Takuma Sadamori, Shingo Ohki, Hiroshi Giga, Junki Ishii, Hiromi Miyoshi, Kohei Ota, Nobuaki Shime

Department of Emergency and Critical Care Medicine, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan

Introduction： Respiratory failure after extubation is frequent and associated with high mortality. Although auscultation of respiratory sounds is a useful method to assess upper airway and lung abnormalities and routinely performed after extubation, the assessment is subjective and depends on the skill of the medical staff. We evaluated the usefulness of our system for quantifying abnormal respiratory sounds for predicting respiratory failure and airway problems after extubation.

Methods: Patients undergoing extubation in intensive care unit were placed on this respiratory sound monitoring system. Respiratory sounds recorded by this system were subsequently analyzed, and the data were blinded to the medical staff. We defined a composite outcome (reintubation, insertion of other airway devices, surgical airway management, unplanned use of noninvasive ventilation or high-flow nasal cannula, or use of inhalers) and compared the quantitative values of abnormal respiratory sounds at each site of the neck and chest between groups with and without the composite outcome.

Results: Fifty-seven patients were included in this study. The composite outcome occurred in 18 patients. The outcome occurrence group had significantly higher quantitative values of stridor (0.037 vs 0.007, p=0.003) and rhonchi (0.088 vs 0.048, p=0.007) in the neck region. The outcome occurrence group had also higher quantitative values for wheezes (right; 0.56 vs 0.20, p=0.047, left; 0.76 vs 0.19, p=0.044), rhonchi (right; 0.077 vs 0.053, p=0.039, left; 0.063 vs 0.039, p=0.045) and coarse crackles (right; 0.069 vs 0.051, p=0.030, left; 0.091 vs 0.053, p=0.036) in the anterior thoracic region, and higher quantitative values for fine crackles (right; 0.013 vs 0.007, p=0.045, left; 0.012 vs 0.004, p=0.016) in the lateral thoracic region.

Conclusion: Quantification of abnormal respiratory sounds by our system may be a predictive indicator of respiratory failure and airway problems after extubation. This research was supported by AMED grant (20he1602002h0004).

1-6

Impact of sepsis on ECOG performance status among fully ambulatory patients: a prospective observational study.

Kyu Jin Lee 1 , Kyeongman Jeon 2 , Gee Young Suh 2 , Dong Kyu Oh 3 , Sang-Bum Hong 3 , Mi-Hyeon Park 3 , Chae-Man Lim 3 , and Sunghoon Park 1

1 Department of Pulmonary, Allergy and Critical Care Medicine, Hallym University Sacred Heart Hospital
2 Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine,
3 Department of Pulmonary and Critical Care Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea.

Introduction: Data on change in performance status after sepsis treatment in previousl ambulatory patients are very scarce.
Methods: Twenty-one hospitals of the Korean Sepsis Alliance participated in this study. Patients who were admitted to the hospitals for a sepsis diagnosis during the 18 months (August 2019 to December 2020) were prospectively enrolled. We investigated changes in Eastern Cooperative Oncology Group (ECOG) performance status before and after sepsis treatment among previously fully ambulatory patients (ECOG equal or less than 1).
Results: During the study period, a total of 7,113 sepsis patients were identified. After exclusion of those with do-not-resuscitation or missing values (n =2,968) and those with ECOG of > 1 (n = 2,265), 1,880 were finally enrolled in this study (66.5 ± 13.5 years; 1,144 males; 365 septic shock). Among the patients with pre-sepsis ECOG of 0, 25.8% (198/766) were not fully ambulatory at hospital discharge (ECOG = 2, n = 34; 3, n = 78; 4, n = 45; 5, n = 41), and among those with pre-sepsis ECOG of 1, 29.0% (323/1,114) were not fully ambulatory (ECOG = 2, n = 129; 3, n = 56; 4, n = 34; 5, n = 104). In patients aged under 65 years, the proportion of those who were not fully ambulatory at hospital discharge was 22.1% (172/770), and in those with no history of cancer, it was 25.5% (296/1,161). In the multivariable model, among significant variables, appropriate antibiotics was a modifiable factor for the aggravation of ECOG performance status (odds ratio, 1.949; 95% confidence interval, 1.250 to 3.038).
Conclusions: Among patients with previously good performance, more than a quarter of them did not recover their previous performance status at hospital discharge after sepsis treatment, which may have an impact on patients' socioeconomic status.

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Oral session（Intensive care　I)

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2-1

Comparison of the emergency difficult airway situation in ICU and outside ICU

Jae Hee Park 1 , Seung Ho Jung1, Kwan Hyung Kim1 , Jeong Min Kim 1 , Mi Ae Kim 2 , Jung Yeoun Kim 2 , Sung Won Na 1

1 Department of Anaesthesiology and Pain Medicine, Anaesthesia and Pain Research Institute, Yonsei University College of Medicine, Seoul, Republic of Korea
2 Department of Intensive Care Nurse Team, Shinchon Severance Hospital, Seoul, Republic of Korea

Objective

To compare the difficult airway situation in Intensive Care Unit (ICU) with non-ICU environment.

Introduction

A difficult airway response team (DART) was implemented by a team of anaesthesiologists in May 2019 at Severance hospital in Seoul, South Korea. The DART actively responds to difficult airway situations in the general ward, ER, ICU and procedural room outside of the operating room.

Method

This is a retrospective study of DART activations between July 10, 2019 and September 28, 2021. Data including airway grade, time to endotracheal intubation, number of intubation attempts, airway devices were recorded by a DART nurse. By reviewing the electronic medical records, patients' characteristics, medical history and prognosis were compared.

Result

Activation of the DART occurred 522 times in 26 months. 220 activations (42%) were ICU patients and 302 (58%) were non-ICU patients. When DART was activated, CPR was much more common in general wards than in ICU (49% vs 10%). In non-ICU, mean time to endotracheal intubation was shorter than ICU (3.3 ± 3.3 min vs. 4.2 ± 4.2 min, $p<0.05$). Using neuromuscular blocker (NMB) before intubation was more common in ICU setting (85% vs 52%, $p<0.05$). Patient's past airway grades were not statistically different ($p=0.93$), but current airway grades were higher in non-ICU patients ($p<0.05$).

Most common reason of emergency endotracheal intubation was severe hypoxemia in both groups. There was 1 case of emergency tracheostomy in non-ICU group, and 0 case reported about airway related complication in ICU group.

Conclusion

DART activations were more common in non-ICU compared with ICU. In general ward, tracheal intubations were done abruptly without proper administration such as NMB, meanwhile patients admitted to ICU were monitored and assessed when they anticipated intubation, and intubation procedure was done more gradually and resulted relatively lower airway grade.

2-2

Efficacy of Nutritional Support Protocol for Patients with Pressure Ulcer: Comparison of Before and After the Protocol

Hye Young Woo 1,2 , Seung-Young Oh 1,2 , Leerang Lim 3 , Hyunjae Im 1 ,Hannah Lee 3 , Ho Geol Ryu 1,3

1 Department of Critical Care Medicine, Seoul National University Hospital
2 Department of Surgery, Seoul National University College of Medicine
3 Departments of Anesthesiology and Pain Medicine, Seoul National University College of Medicine

Instruction: Since most patients who developed pressure ulcer (PU) are malnourished, additional nutritional support is important for PU improvement. In this study, we investigated the potential benefit of the simple nutritional support protocol in PU improvement.

Methods: This study was comparative before and after study, prospectively performed from May to December 2020. Participants were inpatients of Seoul National University Hospital (SNUH), South Korea. Among the patients who developed PU from May to December 2020, those on enteral nutrition (EN) were included in the protocol group. Application of nutritiona support protocol established in May 2020 in SNUH. Serum levels of prealbumin, transferrin, cholesterol, and zinc were measured initially, 2 weeks, and 4 weeks after protocol application to evaluate clinical course. Tailored regimen that adjusted the amount of protein and trace elements was provided according to nutritional support team (NST) consultation. Size and Pressure Ulcer Scale for Healing (PUSH) scale of PU were evaluated every 2 weeks by the same nurse in charge of PU. To validate the efficacy of the protocol, patients who 1) developed PU from May to December 2018, 2) were hospitalized for more than 2 weeks, and 3) received EN were selected as a control group.

Results: Total of 61 patients were included to the protocol group and 100 patients were included to the control group. The protocol group had higher proportion of PU improvement (85.2% vs. 50.0%, $p<0.001$), daily protein intake (1.6 ± 3.2 vs. 0.9 ± 0.4, $p = 0.048$), Braden scale (12.9 ± 1.8 vs. 12.3 ± 1.8, $p = 0.025$) and baseline albumin level (3.1 ± 0.5 vs. 2.8 ± 0.4, $p =0.001$) were compared to the control group. Multivariate analysis showed that implementation of the nutritional support protocol was the most effective factor in improving PU (OR=0.18, 95% CI 0.089-0.366, $p<0.001$).

Conclusions: Simple nutritional support protocol was easy to develop and its application contributed significantly to the recovery of PU.

2-3

Evaluation of Support Requirement by Medical Social Workers in Elderly Patients Admitted to a Critical Care Center: A single-center retrospective study

Shunichiro Nakao, Yuji Fukumori, Yumi Takahashi, Hiroshi Ogura, Jun Oda

Osaka University Graduate School of Medicine, Department of Traumatology and
Acute Critical Medicine, Osaka University Graduate School of Medicine

Introduction

With the aging of the population in Japan, social security may not be fully accessible to the elderly. When admitted to an intensive care unit, they may require support from medical social workers (MSWs). The purpose of this study was to determine the association between the background of elderly patients and the proxy support by MSWs during hospitalization in a critical care center.

Methods

We conducted a retrospective observational study of patients aged 65 years or older who were admitted to the Osaka University Hospital between October 2018 and September 2020, and who required any support from MSW. We assessed the proxy support by MSWs, including application for welfare benefits, long-term care insurance, intractable disease support, disability certificate, high-cost medical care, pension, and guardianship, support for illegal stay, and others. We evaluated the association between background factors such as age, sex, activity of daily living (ADL) before admission, living alone, and having a regular doctor and the assistance by the MSWs with logistic regression.

Results

A total of 304 patients were eligible. The median age was 78, 178 (58.6%) were male, 81 (26.8%) were independent in ADLs, 70 (23.0%) lived alone, and 295 (97.0%) had a regular doctor. The proxy support by MSW was required in 54 (17.8%) cases. Living alone was significantly associated with the need for assistance by MSW (OR 4.25, 95% CI 2.21-8.21), regardless of age, gender, having a regular doctor, or ADL before admission.

Conclusion

Among elderly patients admitted to the critical care center, living alone before admission was associated with the need for proxy support by MSWs. Even if elderly patients have good ADL and a regular doctor, it may be necessary to actively provide social support to those who live alone.

2-4

The association of early enteral nutrition with clinical outcomes in cardiac critically ill patients requiring vasopressors

Shinseok Jeong 1 ; Ryoung-Eun Ko 1 ; Jeong Hoon Yang 1, 2

1 Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
2 Division of Cardiology, Department of Medicine, Heart Vascular Stroke Institute, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Background: Early enteral nutrition (EN) has been emphasized because it is associated with reduced morbidity and mortality in critically ill patients. However, limited data were available on efficacy and safety of early EN in cardiac critically ill patients requiring vasopressors. Thus, we sought to investigate whether early EN can improve clinical outcomes in patients treated with vasopressor who admitted cardiac intensive care unit.
Methods: We enrolled 364 patients received vasopressors between June 2016 and December 2018 in cardiac intensive care unit in Samsung Medical Center in Seoul, Korea. Study populations were divided into early EN (n=276, feeding within 48 hours) and late or no EN (n=88) according to the time from vasopressor initiation to first oral or enteral feeding. Primary outcome was in-hospital mortality.
Results: After vasopressor, enteral feeding followed 227 patients within 24 hours, 49 patients within 48 hours, 62 patients within 120 hours and 18 patients after that. 8 patients had been never fed. To reduce selection bias between two groups, 88 pairs for 1:1 propensity score matched cohort was created. In-hospital mortality rate was similar between early EN group (29.55%) and late or no EN group (22.73%, p = 0.303). In addition, there were no significant difference observed in ICU mortality, 30 day and 90 day mortality, length of stay in ICU and in hospital between the two groups. In multivariable analysis, cardiac arrest as a presentation, albumin, High Vasoactive-Inotropic Score(VIS) on feeding, Increased VIS after feeding, renal replacement therapy and mechanical ventilation were significant predictors for in- hospital mortality but not early EN(p=0.992)
Conclusion: Early EN was not associated with improved clinical outcomes in cardiac critically-ill patients requiring vasopressors. Future well-designed trials will be required to confirm our results.

Table 1. Baseline characteristics

	Overall population			Propensity score matched population		
	Early EN (N=276)	Late EN (N=88)	*p* value	Early EN (N=88)	Late EN (N=88)	*p* value
Demographic variables						
Age	67(56-76)	65(58-77)	0.958	68(59-76)	65(58-76.8)	0.754
Male sex	178(64.49%)	66(75.00%)	0.077	65(73.86%)	66(75.00%)	0.863
Comorbidities						
Current smoking	44(15.94%)	19(21.59%)	0.223	18(20.45%)	19(21.5%)	0.853
Diabetes	117(42.39%)	35(39.77%)	0.664	44(50.0%)	35(39.77%)	0.173
Hypertension	137(49.64%)	43(48.86%)	0.899	44(50.0%)	43(48.86%)	0.880
Body Mass Index	23.09(20.64-25.62)	22.54(20.17-25.59)	0.624	23.98(19.86-27.64)	22.54(20.17-25.59)	0.267
Chronic lung disease	18(6.52%)	1(1.14%)	0.054	2(2.27%)	1(1.14%)	1.000
Chronic liver disease	9(3.26%)	4(4.55%)	0.572	1(1.14%)	4(4.55%)	0.368
Chronic kidney disease	58(21.01%)	21(23.86%)	0.572	22(25.0%)	21(23.86%)	0.861
Solid cancer	33(11.96%)	9(10.23%)	0.658	11(12.5%)	9)10.23%)	0.813
Hematologic malignancy	1(0.36%)	1(1.14%)	0.392	2(2.27%)	1(1.14%)	1.000
Independent ADL	195(70.65%)	53(60.23%)	0.068	55(62.50%)	53(60.23%)	0.757
Diagnosis on shock			0.252			0.072
Acute coronary syndrome	91(32.97%)	34(38.64%)		30(34.09%)	34(38.64%)	
Heart failure	141(51.09%)	33(37.50%)		46(52.27%)	33(37.50%)	
Arrhythmia	19(6.88%)	8(9.09%)		3(3.41%)	8(9.09%)	
Aortic disease	5(1.81%)	3(3.41%)		1(1.14%)	3(3.41%)	
Pulmonary hypertension	11(3.99%)	4(4.55%)		8(9.09%)	4(4.55%)	
Pericardial disease	4(1.45%)	3(3.41%)		0	3(3.41%)	
Others	5(1.81%)	3(3.41%)		0	3(3.41%)	
Cardiac arrest as a presentation	33(11.96%)	33(37.5%)	<0.001	27(30.68%)	33(37.5%)	0.340
SOFA at CICU admission	6(4-9)	8(6-11)	<0.001	9(6-11)	8(6-11)	0.339
Laboratory						
Hemoglobin, □/□	10.30(8.90-12.30)	9.85(8.90-11-28)	0.100	9.00(8.13-11.68)	9.85(8.90-11.28)	0.141
Platelets, 10^3/μL	155.0(109.3-208.0)	114.5(70.3-180.5)	<0.001	131.0(69.3-192.0)	114.5(70.3-180.5)	0.629
Total bilirubin, □/□	1.10(0.70-2.00)	1.30(0.090-2.80)	0.034	1.35(0.80-2.24)	1.30(0.90-2.80)	0.775
Albumin, g/□	3.30(3.00-3.70)	2.90(2.50-3.40)	<0.001	2.95(2.60-3.40)	2.90(2.50-3.40)	0.523
Serum creatinine, □/□	1.35(0.94-2.04)	1.61(1.10-2.08)	0.036	1.64(1.12-2.59)	1.61(1.10-2.08)	0.850
C-reactive protein, □/□	2.29(0.49-7.28)	5.32(0.66-11.48)	0.025	6.26(1.36-10.58)	5.32(0.66-11.48)	0.712
Serum lactate in CICU admission, mmol/L	1.83(1.20-2.90)	3.29(1.58-8.11)	<0.001	2.32(1.40-4.67)	3.29(1.58-8.11)	0.145
Peak serum lactate in CICU, mmol/L	1.98(1.39-3.54)	4.62(2.72-7.79)	<0.001	3.42(2.06-6.06)	4.62(2.72-7.79)	0.037
Troponin-I, ng/ml	1.37(0.13-24.29)	14.09(0.42-115.59)	0.001	4.28(0.25-72.80)	14.09(0.42-115.59)	0.453
NT-proBNP, pg/ml	7335(2435-17772)	5617(1809-15378)	0.328	51061676-17871)	5617(1809-15378)	0.669

Values are presented as median(interquartile range) and number (%). ADL, activity of daily living. SOFA, sequential organ failure assessment score. CICU, cardiac intensive care unit. NT-proBNP, N -terminal fragment of the prohormone brain-type natriuretic peptide.

Table 2. Treatment variables

	Overall population			Propensity score matched cohort		
	Early EN N=276	Late EN N=88	*p* value	Early EN N=88	Late EN N=88	*p* value
Time duration between						
Shock onset to enteral or parenteral nutrition	9.6(3.3-18.2)	70.9(51.1-99.1)	<0.001	14.4(4.8-26.0)	71.0(51.1-99.1)	<0.001
Shock onset to enteral nutrition	10.2(3.4-18.8)	88.7(65.1-114.2)	<0.001	15.4(6.3-26.4)	88.7(65.1-114.2)	<0.001
Vasopressors						
Dopamin	69(25.00%)	24(27.27%)	0.670	27(30.68)	24(27.27%)	0.618
Dobutamin	117(42.39%)	44(50.0%)	0.211	32(36.36)	44(50.0%)	0.068
Norepinephrine	163(59.06%)	75(85.23%)	<0.001	75(85.23)	75(85.23%)	1.000
Epinephrine	21(7.61%)	23(26.14%)	<0.001	12(13.64)	23(26.14%)	0.038
Vasopressin	13(4.71%)	21(23.86%)	<0.001	11(12.50)	21(23.86%)	0.051
Milrinone	33(11.96%)	8(9.09%)	0.459	9(10.23)	8(9.09%)	0.799
Total duration of vasopressors	32.0(10.9-73.5)	104.6(23.8-245.2)	<0.001	53.3(23.2-180.3)	104.6(23.8-245.2)	0.219
Maximal VIS	10.0(5.0-20.8)	32.5(15.0-145.7)	<0.001	20.0(10.2-30.0)	32.5(15.0-145.7)	0.003
VIS on feeding initiation	3.0(0-5)	0(0-6.0)	0.071	4.5(0-8.0)	0(0-6.0)	0.097
Organ support						
Mechanical ventilation	102(36.96%)	71(80.68%)	<0.001	70(79.55%)	71(80.68%)	0.850
ECMO	50(18.12%)	38(43.18%)	<0.001	35(39.77%)	38(43.18%)	0.646
Renal replacement therapy	45(16.30%)	38(43.18%)	<0.001	38(43.18%)	38(43.18%)	1.000
PCI	78(28.26%)	32(36.36%)	0.149	25(28.41%)	32(36.36%)	0.260

ECMO, extracorporeal membrane oxygenator. PCI, percutaneous coronary intervention.

Table 3. Clinical outcomes

	Overall population			Propensity score matched cohort		
	Early EN N=276	Late EN N=88	*p* value	Early EN N=88	Late EN N=88	*p* value
Mortality						
In-hospital mortality	26/276(9.42%)	20/88(22.73%)	<0.001	26/88(29.55%)	20/88(22.73%)	0.303
ICU mortality	14/276(5.07%)	14/88(15.91%)	<0.001	18/88(20.45%)	14/88(15.91%)	0.434
30 day mortality	23/262(8.78%)	18/82(21.95%)	<0.001	22/86(25.58%)	18/82(21.95%)	0.581
90 day mortality	35/250(14.0%)	24/81(29.63%)	<0.001	29/83(34.94%)	24/81(29.63%)	0.467
Length of stay in ICU	3.84(1.91-6.91)	6.97(4.13-16.08)	<0.001	6.20(3.89-12.41)	6.97(4.13-16.08)	0.221
Length of stay in hospital	16.87(7.76-47.41)	25.98(12.88-76.48)	0.001	26.52)11.08-46.08)	25.98(12.88-76.48)	0.137
Independent ADL on discharge	143/276(51.81%)	28/88(31.82%)	<0.001	29/88(32.95%)	28/88(31.82%)	0.432
Independent walking on discharge	153/276(55.43%)	29/88(32.95%)	0.001	34/88(38.64%)	29/88(32.95%)	0.872
Feeding interruption more than 4 hours						
Feeding intolerance	13/276(4.71%)	4/88(4.55%)	1.000	9/88(10.23%)	4/88(4.55%)	0.248
Hemodynamic instability	7/276(2.54%)	3/88(3.41%)	0.71	7/88(7.95%)	3/88(3.41%)	0.329
GI bleeding and ischemia after enteral feeding						
GI bleeding	10/276(3.62%)	5/88(5.68%)	0.370	5/88(5.68%)	5/88(5.68%)	1.000
Ischemic enterocolitis	5/276(1.81%)	5/88(5.68%)	0.066	2/88(2.27%)	5/88(5.68%)	0.444
Documented pneumonia after feeding	15/276(5.43%)	17/88(19.32%)	<0.001	15/88(17.05%)	17/88(19.32%)	0.696

GI, gastrointestinal.

Table 4. Binary logistic regression analysis for in-hospital mortality

	Univariate analysis	Multivariate analysis		
Variables	*p* value	*p* value	HR	95% CI of HR
Age	0.891			
Male sex	0.956			
Cardiac arrest as a presentation	< 0.001	0.033	2.459	1.074-5.632
SOFA at ICU admission	< 0.001			
Diabetes	0.947			
Hypertension	0.134			
Hemoglobin	0.031			
Albumin	< 0.001	0.040	1.943	1.030-3.667
High VIS on EN start (>10)	< 0.001	0.002	3.398	1.548-7.463
Increasing VIS on 24 hours after feeding	< 0.001	0.002	3.730	1.597-8.709
Renal replacement therapy	< 0.001	0.010	2.724	1.268-5.855
Mechanical ventilation	< 0.001	0.031	2.88	1.101-7.539
ECMO	< 0.001			
Total duration of vasopressors	0.130			
Early EN	0.001	0.992	0.996	0.452-2.196

2-5

Easy and Fast Brain Death Test Using Portable Ultrasound in Neuro-ICU

Jin Park

Department of Neurology, Seoul Hospital, Ewha Womans University College of Medicine, Seoul, Republic of Korea

Introduction

Determination of brain death needed accuracy and rapidity. Clinical examination has limitations that difficult to differentiation of mimic condition of brain death, or incomplete apnea test due to complications. Several ancillary test such as transcranial Doppler (TCD) or electroencephalogram study are generally used, however, progress of the brain death test may delayed as these studies need trained person. Recently, portable ultrasonography in ICU by neurointensivist is used increasingly. Blood flow in central retinal artery (CRA), a branch of ophthalmic artery is detected by doppler mode and can be an alternate study of TCD. In this study, the author measures the blood flow pattern in the CRA of brain dead patients by portable ultrasonography and compares this result with TCD.

Methods

The medical record of four potential brain death patients were reviewed from September 2019 to April 2020 in a university hospital. Management of the brain death was followed by protocol and national guideline.

Results

All four patients were compatible with brain death by clinical examination, brain computed tomography (CT), and EEG study. One paYUyuntient was hypoxic brain injury after cardiac arrest, two patients were subarachnoid hemorrhage, and one patient was traumatic brain injury. Mean ONSD were 5.3 mm in right and 5.7 mm in left eye. Blood flow pattern of CRA by portable ultrasonography were as follows; systoli spikes pattern in two patients; increased CRA systolic flow (20/9 cm/s, peak systolic/ end-diastolic velocity); reverberating flow pattern in one patient. Blood flow pattern by TCD were as follows; systolic spikes pattern in two patients; reverberating flow pattern in two patients.

Conclusion

Portable ultrasonography for measurement of CRA blood pattern and ONSD can be an alternative easy and quick ancillary study of determination of brain death. Further study with more cases are needed.

2-6

Multisystem inflammatory syndrome in an adult after COVID-19 vaccination: A case report

Ryo Unita 1) , Satoru Beppu 1)2) , Mariko Terashima 1) , Yuki Sugitani 1) , Kosuke Yoshida 1) ,
Hiroki Shimada 3)

1) Department of Emergency and Critical Care Medicine, Kyoto Medical Center
2) Department of Legal Medicine, Shiga University of Medical Science
3) Department of Cardiovascular Medicine, Shimada General Medical Center

Introduction: Although multisystem inflammatory syndrome (MIS) following infection of COVID-19 has been recognized, the relation to COVID-19 vaccination has not been deeply understood.
Case report: A 52-year-old woman presented to our hospital with fever, transient loss of consciousness and hypotension. Four days ago, she received second COVID-19 Moderna vaccination. At presentation to the hospital, troponin I, C-reactive protein, Neutrophil and NT-pro BNP were elevated, but electrocardiogram didn't show ST-segment change. Transthoracic echocardiography showed depression of cardiac function and cardiac magnetic resonance imaging demonstrated edema and inflammation of both ventricles. After administrating of antibiotics, cardiovascular agents and hydrocortisone intravenously, hemodynamic status and inflammation markers became improved. As diarrhea and rash were presented during the clinical course, we diagnosed as MIS according to the case definition.
Conclusion: We experienced MIS following COVID-19 vaccination. Although ideal management of MIS has not been confirmed, rapid hemodynamic improvement was observed with hydrocortisone in this case. Further investigation of the efficacy of steroid administration in MIS following COVID-19 vaccination is required.

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Oral session（ECMO）

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3-1

Sevoflurane administration from extracorporeal membrane oxygenation for a patient with COVID-19: a breakthrough solution for the shortage of intravenous anesthetics

Yudai Iwasaki 1,2 *, Takuya Shiga 2 , Daisuke Irimada 1,2 , Hidehisa Saito 1 , Daisuke Konno 2 , Koji Saito 2 , Masanori Yamauchi 1

1, Department of Anesthesiology and Perioperative Medicine, Tohoku University Graduate School of Medicine, Sendai, Japan

2, Department of Intensive Care, Tohoku University Hospital, Sendai, Japan

Introduction: One of the major issues encountered during the coronavirus disease 2019 (COVID-19) pandemic has been the shortage of intravenous anesthetics. Moreover, patients undergoing extracorporeal membrane oxygenation (ECMO) need large quantities of intravenous anesthetics for sedation. The use of volatile drugs is one of the solutions to overcome the shortage of intravenous anesthetics.

Method: A 52-year-old-man with a body mass index of 40 kg/m2 and weight of 127 kg was admitted to our hospital due to ARDS by COVID-19 and treated with ECMO. However, sedation control was gradually difficult to regulate due to drug tolerance. We attempted administration of inhaled anesthetics through the ventilator. However, it failed because the minute volume in this case was less than 0.5 L/minute due to the low compliance. Instead, we administered sevoflurane, one of the commonly used inhaled anesthetics via the gas flow of ECMO. The artificial membrane and gas outlet were covered with plastic bags to collect the exhaust gas from the gas outlet which contained sevoflurane. The exhaust gas was collected using a pollution control system via a polyvinyl chloride tube. After this method, we decreased the quantity of intravenous anesthetics and opioids.

Discussion: To our knowledge, this is the first case report on the administration inhaled anesthetics via venovenous ECMO rather than mechanical ventilation. A similar method was established for cardiovascular anesthesia, and we have successfully applied this technique to administer inhaled anesthetics through ECMO. For the universal establishment of this method, it is necessary to ensure safety by monitoring the degree of contamination in the ICU through animal experiments.

Conclusion: We succeeded in sevoflurane administration from extracorporeal membrane oxygenation for a patient with COVID-19. This method might help to overcome the shortage of intravenous anesthetics.

3-2

Endotoxin attachment to extracorporeal membrane oxygenators in an experimental septic shock model

1 Hwa Jin Cho, 2,3 Mukhammad Kayumov, 3 Do Wan Kim, 4 Sainath Raman, 5 Graeme MacLaren, 3 In Seok Jeong

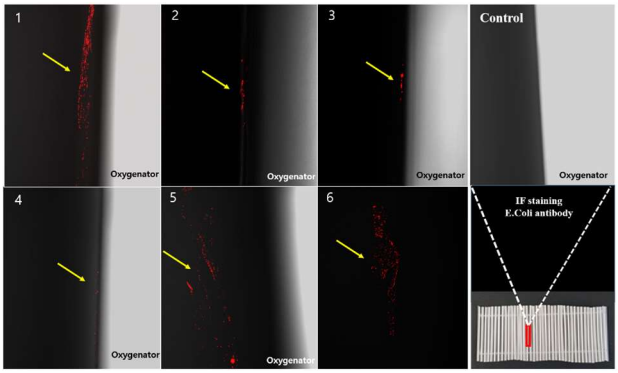
1 Department of Pediatrics, Chonnam National University Children's Hospital, and Medical School, Gwangju, Republic of Korea, 2Chonnam National University Graduate School, 3 Department of Thoracic and Cardiovascular Surgery, Chonnam National University Hospital and Medical School, Gwangju, Republic of Korea, 4 Centre for Children's Health Research, The University of Queensland, Brisbane, Queensland, Australia. 5 Cardiothoracic ICU, National University Hospital, Singapore

Introduction：The role of ECMO in the management of refractory septic shock is controversial and the effects of sepsis on oxygenator function are not well-understood. We aimed to investigate the (i) changes in endotoxin levels before and after ECMO in an experimental septic shock model and (ii) the amount of deposition of endotoxin within the oxygenator.

Material and Methods：Six male Sprague-Dawley rats were included in this study. All rats received human-quality care in compliance with the principles of laboratory animal care formulated by the National Society for Animal Research for the Care and Use of Laboratory Animal Resources as per the supplementary materials. The Chonnam National University Medical School Ethics Committee approved the study (approval N: CNUHIACUC-20017). Sepsis was induced by
injecting 10mg/kg lipopolysaccharide (LPS) intraperitoneally 12 hours before the start of the experiment. The rats were initiated on ECMO after induction of septic shock. They underwent serum endotoxin assay (by Kinetic Turbidimetric LAL assays) before and 2 hours after ECMO initiation. Immunofluorescence (IF) staining of the oxygenators was done at the end of each experiment and compared with six unused oxygenators.

Results：Before ECMO, the mean endotoxin level was 28.24±18.11 EU/ml, which decreased to 17.1±11.22 EU/ml after 2 hours of ECMO. Staining oxygenator fibers with attachment of endotoxin molecules on the fibers' surface, whereas the uncirculated oxygenators had no endotoxin detected. (Fig 1)

Conclusions：In conclusion, we found evidence of a reduction in endotoxin levels shortly after initiation of ECMO. This may be related, at least in part, to deposition of endotoxin within the oxygenator. The effects on both the pathophysiology of sepsis and upon oxygenator function in humans should be the subject of further research.



3-3

The association of respiratory quotient and poor neurologic outcome in patients undergoing extracorporeal cardiopulmonary resuscitation

Yun Im Lee 1 , Ryoung-Eun Ko 2 , Jeong Hoon Yang 2, 3 , Chi Ryang Chung 2, Gee Young Suh 2, 4

1 Department of Internal Medicine, National Cancer Center, Goyang, Gyeonggi-do, Republic of Korea
2 Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
3 Division of Cardiology, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
4 Division of Pulmonary and Critical Care Medicine, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Introduction: Concrete evidence that supports the relationship between markers of hypoxia and poor clinical outcomes after extracorporeal cardiopulmonary resuscitation (ECPR) is lacking. Thus, this study aimed to characterize respiratory quotient (RQ) during the early period after ECPR and compare its ability to predict poor neurologic outcomes with other markers of tissue hypoxia.
Methods: This was a retrospective, single-center, observational study. Medical records of adult patients admitted to the intensive care units after ECPR due to cardiac arrest from May 2004 to April 2020 were reviewed. Patients who survived more than 24 hours were included in the study. Patients who were transferred from other hospitals, with unsuccessful ECPR, with insufficient data to calculate RQ and patients whose blood gases were drawn only before ECPR were excluded. The primary outcome was poor neurologic outcome at discharge, defined as a score between 3 and 5 on the Glasgow-Pittsburgh Cerebral Performance Categories scale.
Results: Among 155 patients, 90 patients had poor neurologic outcome. The poor neurologic outcome group had significantly higher incidences of hypertension, coronary artery disease, chronic kidney disease and out-of-hospital cardiac arrest than the good neurologic outcome group. They also had significantly longer cardiopulmonary resuscitation to pump-on time and higher Sequential Organ Failure Assessment score at intensive care unit admission. The poor neurologic outcome group had higher RQ and lactate than the good neurologic outcome group ($p = 0.021$ and 0.004 respectively). However, in the multivariable analysis RQ was not associated with poor neurologic outcome. Age, out-of-hospital cardiac arrest, cardiopulmonary resuscitation to pump-on time, gastrointestinal bleeding and lactate above 7.1 mmol/L were significantly associated with poor neurologic outcome.
Conclusion: RQ measured within 24 hours of initiation of ECPR was not associated with poor neurologic outcome.

3-4

Echocardiographic Predictors of successful weaning from veno-arterial extracorporeal membrane oxygenation support

Jong Yun Won, Jae-Seung Jung

Dept. of Thoracic and Cardiovascular Surgery, Korea University Anam Hospital

Veno-arterial (VA) extracorporeal membrane oxygenation (ECMO) has been widely used for dealing with various cases of shock. However, there is a lack of evidence about the predictors of successful VA ECMO weaning. We aimed to identify the predictors of successful VA ECMO weaning focusing on echocardiographic and hemodynamic parameters. From January 2010 to June 2018, we retrospectively reviewed 109 patients who received VA ECMO support at our institution. Serial echocardiographic data and hemodynamic parameters at the initiation of ECMO support and at trialing off ECMO were reviewed. Logistic regression was performed. Among 109 patients, 72 patients were males. The mean age was 59 ± 15 years. VA ECMO was indicated mainly for 65 (60%) patients with acute coronary syndrome, and secondly eight patients with decompensated heart failure and eight patients with arrythmia. 64 (59%) patients were weaned from ECMO successfully. In the multivariate analysis, we used aortic time velocity integral (VTI), tissue doppler mitral annulus peak systolic velocity (TDSa) and the mean arterial pressure values at both the initial insertion of ECMO, and before weaning. Result showed high VTI and MAP before weaning as predictors of successful VA ECMO weaning (OR, 1.54; 95% CI, 1.04–2.30; p = 0.03, and OR, 1.13; 95% CI 1.03-1.23; p=0.01, respectively). High Mean arterial pressure and VTI in echocardiography at the time of ECMO weaning seemed to predict successful VA ECMO weaning.

3-5

A case of right ventricular impalement injury treated surgically after early computed tomography diagnosis and extracorporeal membrane oxygenation in the hybrid emergency room

Masafumi Suga, Shinichi Ijuin, Akihiko Inoue, Satoshi Ishihara, Haruki Nakayama, Chiaki Hara, Hiroki Yokoyama, Shinichi Nakayama

Department of Emergency and Critical Care Medicine, Hyogo Emergency Medical Center

Background: Impalement injury of the heart is rare and fatal. Individualized treatment strategies are required based on the severity of injury and affected organs. Computed tomography (CT) can help decision-making; however, it is difficult to perform CT safely due to the risk associated with moving patients, especially those in an unstable condition. In 2017, we instituted a new trauma workflow concept called the “hybrid emergency room” (Hybrid ER) that combines a sliding CT system with interventional radiology features to permit CT examination and emergency therapeutic intervention without moving the patient. We report a case of impalement cardiac injury, wherein the patient underwent rapid resuscitation by safely performing veno-arteral (VA) extracorporeal membrane oxygenation (ECMO) after early CT diagnosis in our Hybrid ER and was successfully treated by surgery in the operation room (OR). Case presentation: A 55-year-old man was admitted to our Hybrid ER with a large lumber impaled in situ in the right side of the chest. His vital signs were unstable, but consciousness was maintained. To formulate a treatment strategy, early CT examination was performed without moving the patient. CT revealed pericardial effusion, right lung contusion, and bilateral pneumothorax. The patient was considered to be in obstructive shock, because there were no signs of hemothorax or aortic injury. Because he was in a state of peri-arrest, the risk during transportation to the OR was high. Thus, VA ECMO under radiographic fluoroscopy was performed in the Hybrid ER in preparation for surgery. In the OR, surgical exploration demonstrated a rupture in the right ventricle, and cardiac repair was performed. VA ECMO was stopped just after the operation.

After in-patient rehabilitation, he was discharged on postoperative day 10 without remarkable sequelae.
Conclusions: This case highlights the importance of the combination of early diagnosis and immediate stabilization in the Hybrid ER and definitive therapy in the OR for the successful treatment of patients with severe impalement cardiac injury.

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Oral session（COVID-19）

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4-1

Favorable outcomes in critically ill COVID-19 during ongoing pandemic period

Young-Jae Cho*, Myung Jin Song, Sung Yoon Lim, Yeon Joo Lee, Ho Il Yoon

Division of Pulmonary and Critical Care Medicine, Department of Internal Medicine,
Seoul National University Bundang Hospital, Seongnam/Gyeonggi-Do, South Korea

Introduction: A nationwide huge increase of new coronavirus disease 2019 (COVID-19) cases is ongoing, however critically ill cases are still controllable currently. We aimed to review previous intensive care for severe, critically ill COVID-19 patients and analysis their clinical outcome, especially mortality by demographics and severity.

Methods: We retrospectively enrolled all COVID-19 patients who were confirmed by positive SARS-CoV-2 PCR test, admitted to the national infectious diseases quarantine unit, and applied with at least a high flow nasal cannula (HFNC) or mechanical support such as a ventilator or extracorporeal membrane oxygenation (ECMO). Mortality was analyzed by baseline demographics such as age, sex or severity, and showed their trends over the time course.

Results: From Feb 2020 to Aug 2021, 139 patients were enrolled; median age 65 (28-94), female 33.8% (47/139), and 59% (82/139) supported by mechanical ventilation (MV) and ECMO. There is no death under the 40s and overall mortality 24.5% (34/139); female vs. male = 7.9 (11/139) vs. 16.5% (23/139); HFNC vs. Non-HFNC = 6.5 (8/139) vs. 18.0% (26/139); MV vs. MV and ECMO = 10.8 (16/139) vs. 7.2% (10/139). All death in HFNC occurred in patients with more than 80s with informed consent with "do not resuscitation". In MV and ECMO subgroup (n=25), there is no patient who was initiated by ECMO over the 80s, overall mortality was 40.0% (10/25). This was similar (37.4%) with the international ECMO cohort mortality.

Conclusions: Favorable outcomes in critically ill COVID-19 patients were gradually achieved during the ongoing pandemic period. Current critical care could be still effective even nationwide huge increase of new COVID-19 cases. The impact of the variant virus, lower aged cases, and increasing vaccination should be considered to interpret the fatality in critically ill COVID-19.

4-2

Therapeutic versus prophylactic anticoagulation in COVID-19 inpatients: a multicenter retrospective cohort study in Japan

Hiroki Iriyama 1,2 , Toshikazu Abe 1,2 , Akira Komori 1,2 , Jun Komiyama 2 , Yuta Taniguchi 2 , Motohiko Adomi 2,3 , Ryota Inokuchi 2 , Nanako Tamiya 2 , Masao Iwagami 2

1: Department of Emergency and Critical Care Medicine, Tsukuba Memorial Hospital
2: Department of Health Services Research, University of Tsukuba
3: Department of Epidemiology, Harvard T.H. Chan School of Public Health

Introduction

COVID-19 inpatients should receive prophylactic-dose anticoagulation to reduce the risk of thromboembolic events, especially venous thromboembolism (VTE). However, recommending therapeutic-dose anticoagulation to COVID-19 inpatients is controversial. Therefore, we evaluated the effectiveness and safety of therapeutic-dose anticoagulation compared to pharmacologic thromboprophylaxis using real-world data from Japan.

Methods

This was a retrospective cohort study utilizing a large-scale multicenter inpatient claims database of Medical Data Vision Co. in Japan, including nearly 400 acute care hospitals. COVID-19 in patients who received any anticoagulant. after being hospitalized were identified. We compared inhospital mortality, ventilator, and extracorporeal membrane oxygenation use after admission, VTE incidence, and major bleeding between patients who received intravenous therapeutic-dose anticoagulation and those who received subcutaneous pharmacologic thromboprophylaxis (defined as administrated).

Results

We identified 16,790 COVID-19 inpatients in 2020 from the database. Only 405 (2.4%) patients were treated with anticoagulation after admission, probably because most COVID-19 inpatients in Japan had mild symptoms. Of them, 224 (55.3%) received therapeutic and 181 (44.7%) received prophylactic anticoagulation. Among patients treated with therapeutic and prophylactic anticoagulation, the rates of crude inhospital mortality were 8.9% and 11.1% (P = 0.477), ventilator use were 8.5% and 8.3% (P = 0.944); ECMO use were 0.5% and 0.6% (P = 0.880), VTE incidence were 4.9% and 1.1% (P = 0.031), and incidence of major bleeding were 3.1% and 0.6% (P = 0.064), respectively. The odds ratio for inhospital mortality was 1.07 (95% confidence intervals 0.53–2.14) after adjustment for age, sex, oxygen use, catecholamine use, and steroid use on the first day of admission in patients with prophylactic anticoagulation compared with those with therapeutic anticoagulation. Sensitivity analyses did not change the results.

Conclusions

Among COVID-19 inpatients in Japan, therapeutic-dose anticoagulation did have better benefits than pharmacologic thromboprophylaxis.

4-3

Low implementation of evidence-based and supportive ICU care during the COVID-19 pandemic – a crucial message to all ICU staff

Keibun Liu1; Kensuke Nakamura2; Hajime Katsukawa3; Shigeaki Inoue4,5; Osamu Nishida 6

1. Critical Care Research Group, Faculty of Medicine, University of Queensland and The Prince Charles Hospital, Brisbane, Australia
2. Department of Emergency and Critical Care Medicine, Hitachi General Hospital, Hitachi, Ibaraki, Japan
3. Japanese Society for Early Mobilization, Tokyo, Japan
4. Emergency and Critical Care Center, Kobe University Hospital, Kobe, Japan
5. Department of Disaster and Emergency Medicine, Kobe University, Graduate School of Medicine, Kobe, Japan
6. Department of Anesthesiology and Critical Care Medicine, Fujita Health University School of Medicine, Toyoake, Japan

[Introduction]
Evidence-based ICU care, such as the ABCDEF bundle, should be established as a routine to improve outcomes of ICU patients. However, drastic changes related to the COVID-19 pandemic could prevent it. This aim is to investigate the implementation of the ABCDEF bundle during the pandemic.
[Methods]
This study includes two point prevalence surveys; a two-day point prevalence surve (3 th June and 1 st July 2020) and a one-day point prevalence survey (27 th January 2021). The first survey aimed to collect only data of COVID-19 patients, whereas the second survey collected data of both COVID-19 and non-COVID-19 patients. The surveys were performed as an online questionnaire-based survey (Google Form) with the same definition of the ABCDEF bundle. The primary outcome is the implementation of an entire of the ABCDEF bundle, and the implementation for each element of the bundle were investigated secondary.
[Results]
In the first survey, 262 patients were registered from 212 ICUs in 38 countries. In the second survey, 135 ICUs from 54 countries register 1,229 patients, including 607 COVID-19 patients and 622 non-COVID-19 patients. The implementation rate of an entire of the ABCDEF bundle was 1% (first survey, COVID-19), 1% (second survey, COVID-19), and 0% (second survey, non-COVID-19). Implementation rates of each element were as follows; element A (regular pain assessment: 45%, 55%, and 64%), element B (both spontaneous awakening and breathing trials: 28%, 10%, and 17%), element C (regular sedation assessment: 52%, 61%, and 45%), element D (regular delirium assessment: 39%, 35%, and 39%), element E (exercise: 35%, 16%%, and 12%), element F (family engagement/empowerment:16%, 30%, and 16%).
[Conclusion]
The implementation of the ABCDEF bundle was extremely low, even compared to the levels reported before the COVID-19 pandemic. This study revealed an urgent and unmet need for establishing evidence-based ICU care for all ICU patients.

4-4

Family caregiver's responses to visitation restriction policy at a Korean surgical intensive care unit before and during the coronavirus disease 2019 pandemic

Jiwoo Suh 1, Sungwon Na 1 , Seungho Jung 1 , Kwan Hyung Kim 1 , Sungji Choo 1 ,
JiYeon Choi 2, Jeongmin Kim 1

1 Department of Anesthesia and pain medicine, Sinchon Severance hospital, Seoul, Republic of Korea
2 College of Nursing, Mo-Im Kim Nursing Research Institute, Yonsei University, Seoul, Republic of Korea

Due to the coronavirus disease 2019 (COVID-19) pandemic, the World Health Organization (WHO) has prioritized preventing the spread of infectious diseases and has recommended limiting visitors to the intensive care unit (ICU). This is a recommendation against the recent ICU trend that emphasizes flexible family visitation, thus posing a challenge for many intensivists. This study aimed to (1) compare the quality of life, depressive symptoms and emotional state of family members of surgical ICU patients before and after the COVID-19 pandemic, and (2) explore perceptions and suggestions for visitor restriction policies among the families of critically ill patients in Korea. This descriptive study involved a cross-sectional survey in the family caregivers of adult surgical ICU patients from February to July 2021. To compare the caregivers' current responses with those before the COVID-19 pandemic, we used the data obtained from our previous study conducted in the same setting from January to July 2017. The quality of life was assessed using the WHO's quality of life survey WHOQOL, 26 items). The Center for Epidemiologic Studies Depression Scale (CES-D, 20 items) was used to assess depressive symptoms. The Visual Analogue Scale (VAS) 100 mm was used to evaluate the subjective states of five basic emotions: happiness, sadness, anger, anxiety, and comfort. The Family Awareness Survey (9 items) was used to assess the caregivers' perceptions, preferences, and suggestions for the ongoing visitation restriction policies following the COVID-19 pandemic. Additional questions included caregiver satisfaction, concerns, and suggestions about the current visitation policy. In conclusion, during the COVID-19 pandemic, the anxiety and sadness of those caring for the families of critically ill patients is growing. Although most families acknowledged that visitation restrictions were a necessary policy, information requirements about the patient's health condition and treatment plan were not adequately met.

4-5

Clinical outcomes of COVID-19 patients requiring mechanical ventilation -Comparison between waves 1st-3rd and waves 4th-5th

Nobuaki Shime, Kazuya Kikutani, Mitsuaki Nishikimi, Satoshi Yamaga, Shinichiro Ohshimo

Department of Emergency and Critical Care Medicine, Graduate School of Biomedical & Health Sciences, Hiroshima University

Introduction

Treatment and outcomes of novel coronavirus disease 2019 (COVID-19) can be affected by the available treatment options, changes in healthcare systems, the emergence of mutant strains, the number of patients requiring ICU admission, or availability of ICU beds. We compared the treatment and outcomes of critical COVID-19 cases in the later periods with that in earlier periods.

Methods

Patients with critical COVID-19 cases requiring mechanical ventilation at Hiroshima University Hospital from March 2020 to November 2021 were enrolled. Data on patient background, severity of illness, therapeutic interventions, and outcomes were retrospectively collected from the medical charts. The results were compared between cases admitted in the earlier (March 2020 to February 2021) and later periods (March to November 2021). ICU patients load during hospitalization of COVID-19 cases was calculated and its association with patients' outcomes were assessed.

Results

A total of 56 patients with COVID-19 required mechanical ventilation (30 patients in earlier group and 26 patients in later group). PaO 2 /F I O 2 ratio at ICU admission was significantly lower (118 vs 148, p=0.008), and the number of days from onset to ICU admission was significantly longer (9.8 vs 7.5 days p=0.027) in the latter group. In-hospital mortality was 27% (p=0.31) in the latter group compared to 13% in the earlier group. The incidence of ventilator- associated pneumonia and bacteremia tended to be higher in the latter group.

Patients who underwent tracheostomy or died in the hospital had a higher ICU patient load than others (51 vs 40%, p=0.034). ICU load was significantly higher in patients who discharged with respiratory support (54% vs 42%, p=0.046).

Conclusion

Patients in the later endemic periods took longer time to enter the ICU, had more hypoxemia on admission, and were more likely to be refractory to treatment. There was an association between ICU patient load and outcome.

4-6

Clinical research for decision making in the initiation of mechanical ventilation therapy using ROX index and chest CT images in COVID-19 patients; Single-center retrospective cohort study

Kazuki Sudo , Mao Kinoshita , Yuasa Kento , Keita Inoue , Junya Ohara , Kentaro Muranishi , Teiji Sawa

Department of Anesthesiology, Kyoto Prefectural University of Medicine

Introduction
High flow nasal cannula (HFNC) has been used for patients with severe respiratory failure. Patients with COVID-19 can avoid ventilator management while using HFNC for COVID-19 but may delay the decision to apply ventilator management. In treating COVID-19 patients with respiratory failure, it is crucial to decide whether to continue therapy with HFNC or start mechanical ventilation. ROX index has been utilized for HFNC patients as an index to determine the need for mechanical ventilation, but a more accurate index may be needed. The purpose of this study is to search for a more precise indicator by analyzing chest CT images that allow us to see a more objective severity of pneumonia.
Methods
Thirty-eight patients treated with HFNC and 38 needed mechanical ventilation were involved in this study. 3D-Slicer (Ver4.11) was used to analyze CT images and calculated the percentage of Lung Infiltrate Volume (LIV). Multiple logistic regression analysis was performed to compare HFNC and mechanical
ventilation. P-values <0.05 were considered to indicate significant differences.
Results
ROX index (odds ratio; 0.494, 95% CI; 0.369-0.661, p<0.01) about 2 hours after the start of treatment with HFNC and LIV on chest CT images (odds ratio; 1.068, 95% CI; 1.016-1.123, p<0.01) were detected as indices for the application of mechanical ventilation. ROX index and LIV ROC curve results (AUC; 0.885, 95% CI; 0.821-0.949, sensitivity; 57.9%, specificity; 89.2%) showed an increase in AUC compared to the ROX index alone (AUC; 0.851, 95% CI; 0.781-0.921, sensitivity; 71.1%, specificity; 89.2%)
Conclusion
This study suggests that adding LIV to the ROX index provides a more accurate predictor for determining patients requiring mechanical ventilation management.

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Oral session（Intensive care　II）

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5-1

The research for clinical and nutritional effect of ω-3 fatty acid-based parenteralnutrition on animal experiment

Han-Young Lee 1 , Jae-myeong Lee 2

1 Department of Surgery, Seoul Medical Center, Seoul, Republic of Korea
2 Division of Acute Care Surgery, Department of Surgery, Korea University Anam Hospital, Korea University Medical Center, Seoul, Republic of Korea.

OBJECTIVES: Omega-3 fatty acid supply is getting important in critically ill patients' nutritional support. This swine animal study aimed for evaluating the role of omega-3 fatty acid on acute phase immunomodulation.
METHODS: Total 20 pigs with hypovolemic shock model (1000 ml blood discard from the baseline and total 2000ml fluid resuscitation) were used. Two different types of total parenteral nutrition (Nutriflex®, B. Braun vs. Winuf®, JW Pharmaceutical Corporation) were given to each 10 pigs for 5 days after fluid resuscitation. Blood sampling were performed 4 times; 1) Baseline - before blood discard, 2) Before starting TPN infusion, 3) Third day of TPN infusion, 4) Fifth day of TPN infusion.
RESULTS: Omega-3 fatty acid group showed higher suppression of neutrophil count (36.15% vs. 43.2125%, p = 0.395) and higher increase of lymphocyte count (61.2125% vs. 45.7125%, p = 0.109). Omega-3 fatty acid group presents higher lactate decrement (0.9333 mmol/L vs. 1.6444 mmol/L, p = 0.199). There was better improvement of BUN (4.95 mg/dL vs. 7.19 mg/dL, p = 0.418), but not in creatinine (1.10 mg/dL vs. 1.09 mg/dL, p = 0.753). Improvement tendency was observed, but there was no evidence of statistically significant difference.
CONCLUSIONS: Early immunomodulation from neutrophil dominant to lymphocyte dominant is anticipated with administration of omega-3 fatty acid. According to lactate decrement, better regulation of shock status is also expected.

5-2

Negative pressure pulmonary edema suspected in a patient after an emergency ascent while scuba diving: a case report

Yushi U. Adachi, Shinichi Koshiba

Department of Emergency Medicine, Shizuoka Saiseikai General Hospital

Decompression illness is one of diving-related injuries and is widely known. Not only decompression but also there are many types of injuries during scuba-diving. Recently the number of cases developing pulmonary edema in healthy persons increases. Subsequent severe hypoxia sometimes requires intensive care.
Case presentation: A 44-year-old female was evacuated by air transportation because of a suspicion of decompression sickness after an emergency ascent while scuba diving. The elapsed time diving was 16 min, and the maximum sea water depth was 19 m. There was a possibility of equipment failure. She complained of dyspnea and bloody sputum after surfacing and the paramedics recognized hypoxemia using pulse oximetry (< 90%). After arriving at our hospital, recompression therapy was quickly initiated. Her symptoms alleviated within 3 hours. Although her oxygenation recovered, an infiltration shadow on computed tomography (CT) was larger on the next day. While additional ventilatory support in intensive care unit was under consideration, her oxygenation was maintained by conservative therapy. After reviewing her dive record and consulting a respiratory physician, the development of acute pulmonary edema was considered to be negative-pressure pulmonary edema.
On the hospital day 4, the CT abnormality had rapidly vanished, and she was discharged without complications.
Discussion: We had difficulty to identify the cause of progressive pulmonary edema with severe hypoxia. At first, the result of the emergency ascent was strongly suspected, and second, the possibility of swimming-induced pulmonary edema was discussed. But the diving record vitiated the speculation. Moreover, she explained the accidental condition that air flow from the regulator was temporally stopped. Thus, the strong inspiratory effort might induce negative pressure pulmonary edema. Pulmonary edema is one of popular pathological conditions in intensive care but contains complicated factors.
References: Chest 2021; 160:1789-98. Eur Respir J 1995; 8: 762-7. Sports Med Open 2018; 4: 1.

5-3

A case of bilateral severe atelectasis following the short duration surgery

Atsushi Kotera

Department of Anesthesiology, Kumamoto City Hospital

[Case] I present a case of bilateral severe atelectasis following the short duration surgery. The patient is a 69-year-old woman (height; 150cm, body weight; 62kg). She was diagnosed as osteoarthritis of her right hip joint, and the right total hip arthroplasty was scheduled under general anesthesia.
[Clinical Course] Her preoperative physical condition was good, and her oxygen saturation was 95% on room air. I performed endotracheal intubation following the induction of general anesthesia by using propofol, fentanyl, remifentanil, and rocuronium. However, the oxygen saturation decreased gradually and became 90% under 45% inhaled oxygen concentration. I thus set the concentration of inhalational O 2 as 60-70%. The mode of mechanical ventilator during the operation was pressure control ventilation; inspiratory pressure: 18-22 cmH 2 O, PEEP: 5-8 cmH 2 O, and respiratory rate 12-15 /min. The respiratory related parameters during the surgical procedure were as follows; tidal volume: 250-300 ml, end tidal CO 2 : 35-40 mmHg, and oxygen saturation: 93-96%. The duration of operation was 87 minutes, and the PaO 2 at the end of surgery was 166 mmHg under 100% inhaled oxygen concentration. Chest CT scan revealed severe atelectasis at the bilateral lower lung field, and I decided that extubation was inappropriate because of hypoxemia. She was transferred to the ICU to continue mechanical ventilation. At the ICU, changing patient's position and endotracheal toileting were administered, and she was extubated at the 3 rd postoperative day successfully.
[Conclusion] The atelectasis during the mechanical ventilation by using muscle relaxant is a common cause of hypoxemia, and a high PEEP setting is known to be a useful method to prevent the atelectasis. However, this case demonstrated that the hypoxemia following atelectasis would happen immediately after the use of muscle relaxant and that 8 cmH 2 O of PEEP might be insufficient to prevent atelectasis.

5-4

Sex-related differences of patients with sepsis: a nationwide cohort study

Ryoung-Eun Ko 1 , Gee Young Suh 1,2

1 Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea
2 Division of Pulmonology and Critical Care Medicine, Department of Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea2

Background: The impact of sex on sepsis is in highly controversial discussion. This study aims to describe the impact of sex on clinical characteristics and outcome in patients with sepsis in Korea.
Methods: We conducted a prospective observational study using the national multicenter registry of the Korean Sepsis Alliance. All consecutive patients aged 19 years or older who were admitted to the general ward or emergency department between September 1, 2019, and December 31, 2020, were screened for eligibility. Patients who fulfilled the diagnostic criteria for sepsis and septic shock, as stated in the Third International Consensus Definition for Sepsis and Septic Shock (Sepsis-3) were included.
Results: Of 6,186 patients with sepsis, the proportion of men was 58.7% (n = 3,632). Men had more chronic obstructive lung disease, chronic liver disease, and myocardial infarction. Of the sites of infection, men showed more respiratory tract infections (49% versus 34.6%, P <0.001), and women showed more urinary tract infections (26.1% versus 13.3%, P<0.001). No significant differences were observed in the appropriateness of initial antibiotics, infection source control, and sepsis bundle completion between the two groups. In addition, there was no significant difference in intensive care unit (ICU) admission and ICU mortality. However, men were significantly increased in-hospital mortality (26.9% versus 24.0, P = 0.024), ICU length of stay (9.29 ± 13.58 versus 7.52 ± 9.62, P<0.001), and hospital length of stay (22.82 ± 31.56 versus 19.40 ± 23.21, P<0.001).
Conclusions: In patients with sepsis, the proportion of men was higher than women. Although there was no significant difference in initial sepsis management, men were associated with worse clinical outcomes than women, including hospital mortality, ICU length of stay, and hospital length of stay.

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5-5

Cardiac tamponade secondary to chest tube insertion

Takayuki Kai

Department of Emergency Medicine, Ichinomiya Nishi Hospital, Japan

Chest tube insertion is a common and should be safe procedure. However, the complication is not rare and some of them are life-threatening. I present the case of cardiac tamponade secondary to chest tube insertion.
A 72-year-old male was admitted due to recurrent pneumothorax. A chest tube was successfully placed. For the treatment of persistent air leak, talc pleurodesis was performed. Since the chest tube was nearly obstructed, another chest tube was placed. During chest tube insertion, blood came out through the chest tube. The chest tube was soon clamped, thoracic surgeons were called and rapid response system was activated. Thereafter, he went into cardiac arrest and underwent cardiopulmonary resuscitation. Echocardiography showed cardiac tamponade. A cardiac surgeon was called and resuscitative thoracotomy was performed. Soon after pericardiotomy, he had returned of spontaneous circulation. Pulsatile blood from left ventricular perforation was found. Left ventricle injury was sutured and bleeding successfully stopped. He was admitted to intensive care unit and got hemodynamically stable. Second look operation was performed on the next day to re-evaluate left ventricular injury. No Bleeding was found and chest wall was closed. Consecutively, video-assisted thoracic surgery was performed for the treatment of pneumothorax. He was extubated three days later. He was discharged without neurological deficit.
In this case, multidisciplinary cooperation was achieved soon after rapid response system was activated. The rapid diagnosis and treatment of cardiac tamponade was also important. In respect to the safety management, we must understand and educate the risk and safer methods of chest tube insertion. Previous studies showed complication rates ranging from 6 to 37 percent and trocar technique was inadvisable. The lethal complication like cardiac tamponade can occur secondary to chest tube insertion.

5-6

Coronavirus Pandemic and Intensive Care Unit in Rural City Municipal Hospital

Yushi U. Adachi, Shinichi Koshiba

Department of Emergency Medicine, Shizuoka Saiseikai General Hospital

Introduction: Coronavirus pandemic absolutely requires changes on the roles of physicians especially in relatively small municipal hospitals. We experienced a hospital-associated cluster in the last year. The current presentation introduces the ingenuity of our medical care system.

Case: The hospital has 521 beds including 27 beds for intensive care. There are approximately 125 physicians, 430 nurses and 200 co-medical staffs for providing clinical services in the institute. Maximally 5 beds of intensive care unit (ICU) and 48 beds of ward were prepared for admission of coronavirus infected patients. On 17 th November 2020, polymerase chain reactive examination (PCR) revealed 5 new cases of infection on the nurses and two days later, other 10 hospitalized patients and 2 assistant workers were diagnosed as coronavirus infection.

Discussion: Concerning to the severe cases, the highest intensive care had been attention, e.g., mechanical ventilation and extracorporeal membrane oxygenation (ECMO). Our municipal hospital has a cardiopulmonary bypass system for a cardiac surgery; however, we have no experience of ECMO operation. The intensivists made their most efforts on the primary prevention of intrahospital infection through the ICU. The pulmonologists directly managed each patient in the early period, but in the later phase, they comprehensively conducted all physicians who gave care the coronavirus infected patients. The redistribution of patients care efforts could abbreviate the physiological and psychological threat and might be effective for preventing further spreading of infection. The final PCR-positive cases were observed on 26 th November; thus, we declared the termination of the intra-hospital pandemic on 10 th December, about one month later from the recognition of spreading. Thereafter, we have no cluster infection in the institute despite of many infected patients' hospitalization.

Conclusion: Unlike university hospitals and tertiary hospitals, mid-scale hospitals is required to adapt new and unexpected difficulties using limited medical resources as quickly as possible.

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Oral session（Intensive care　III）

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6-1

Characteristics of scenes in which mechanically ventilated critically ill patientsactively communicate: Video-based descriptive observational study

Akiko Yamaguchi 1,　Haruna Fukushige 1, Atsue Ishii 1, Sayaka Suga 1, Yoshiaki Inoue 2, Izumi Akada 1, Rie Mitani 2, Akiko Ito 2, Akihito Nakajima 2, Manabu Ono 2, Akiko Yamada 3, Yoko Arima 4, Chushu Chen 1

1, Department of Nursing, Graduate School of Health Sciences, Kobe University, Kobe, Japan
2, Department of Information and Communications Technology, Graduate School of Engineering, Osaka University, Suita, Japan
3, Department of Nursing, Higashi Takarazuka Satoh Hospital, Takarazuka, Japan
4, Department of Nursing, Kawasaki Hospital, Kobe, Japan

Introduction: Healthcare professionals need to address communication problems faced by mechanically ventilated critically ill patients. To examine communication practices between healthcare professionals and patients, this study aimed to clarify the content of patients' messages that nurses understood in patient-started two-way communication scenes and the duration required for nurses to understand those messages.

Methods: Seven patients and seven registered nurses participated in the study. Data about the patients and nurses were collected through video recording at three units of two hospitals in Japan between July 2019 and June 2020. Two- way communication scenes started by the patients were extracted from the footage and were analyzed descriptively. The ethics committee of Kobe University (approval number 682) and the hospitals (approval numbers 1-6 and 1-4-1) approved this study.

Results: We video recorded 668.0 min (38.0–194.8 min), from which 36 two-way communication scenes started by patients were extracted. In 30 of the 36 scenes, the nurses understood what the patients conveyed. In 16 of the 30 scenes, the nurses understood physical symptoms, such as pain, dyspnea, or thirst, and in 7 scenes they understood unique requests of individual patients, such as a desire to go home or the location of the patient' s cell phone. The duration required for nurses to understand physical symptoms was shorter than that required to understand unique requests. For example, the mean duration required for the nurses to understand the patient's message was 26.4 sec (3.8–60.9 sec) for dyspnea, 23.2 sec (3.6–95.1 sec) for pain, and 177.2 sec (159.1–195.2 sec) for the desire to go home.

Conclusion: The messages that the patients actively communicate are pressing and important to them. Healthcare professionals need to be familiar with what the patients often communicate, allow sufficient time for communication, and understand the patients' messages.

6-2

Association of vitamin D with infarction-related arrhythmia in patients with acute myocardial infarction

Jin Wi

Division of Cardiology, Department of Internal Medicine, Gachon University Gil Medical Center
Republic of Korea

Introduction: Infarction-related arrhythmia is major complication of acute myocardial infarction (AMI). Vitamin D deficiency has been reported to be related to various cardiovascular diseases. This study investigated the association of vitamin D with infarction- related arrhythmia in patients with AMI.

Methods: We prospectively analyzed clinical data from all consecutive AMI patients. Infarction-related arrhythmia was defined as ventricular arrhythmias [ventricular fibrillation (VF) and ventricular tachycardia (VT)] and atrial arrhythmias [atrial fibrillation (AF) and atrial tachycardia (AT)] documented in in-hospital continuous EKG monitoring for at least 48 hours after development of AMI. Vitamin D deficiency was defined as 25(OH)D <20 ng/mL.

Results: A total of 189 patients [142 men (75%), mean age 66±14 years] were included in this study. Among them, ST-segment elevation myocardial infarction (STEMI) was diagnosed in 90 (48%) patients and non-STEMI was diagnosed in 99 (52%) patients. Overall 142 infarction-related arrhythmias, including 12 VFs, 81 VTs (21 sustained, 60 non-sustained), 33 AFs, and 16 ATs, were observed in 99 (52%) patients. Patients with infarction-related arrhythmia were older (68±12 vs. 63±14 years, p=0.010) and likely to have more STEMI (60 vs. 34%, p=0.001), multi-vessel coronary disease (77 vs. 62%, p=0.027), cardiogenic shock (30 vs. 10%, p=0.001), and mechanical ventilation support (23 vs. 1%, p<0.001). Baseline renal dysfunction (estimated glomerular filtration <60 mL/min, 41 vs. 24%, p=0.017) and Killip class of 2 or more (49 vs. 23%, p<0.001) were also frequently observed in patients with infarction-related arrhythmia. Patients with infarction-related arrhythmia had lower vitamin D (13.1±5.4 vs. 17.7±7.2 ng/mL, p<0.001). In multivariate logistic analysis, vitamin D deficiency (OR 6.01, 95% CI 2.23-16.18, p<0.001), including STEMI, cardiogenic shock, and age, was the significant independent predictor of infarction-related arrhythmia.

Conclusions: Vitamin D deficiency is the important independent predictor of infarction-related arrhythmia in patients with AMI.

6-3

Association of low-intensity continuous renal replacement therapy and clinical outcomes

Kosuke Yagi 1) , Akira Kageyama 2) , Junpei Ikeda 3) , Tomoko Fujii 1)

1)Intensive Care Unit, Jikei University Hospital, Tokyo, Japan
2)Department of Pharmacy, Jikei University Hospital, Tokyo, Japan
3)Department of Clinical Engineering Technologist, Jikei University Hospital, Tokyo, Japan

Introduction: Continuous renal replacement therapy (CRRT) is generally performed with lower intensity in Japan than the global standard. However, its impact on patient outcomes is unknown. Therefore, we aimed to assess the association of intensities of CRRT and clinical outcomes.
Methods: This was a single-center retrospective observational study. Adult patients requiring CRRT for acute kidney injury admitted to the ICU from September 2013 to November 2020 were included and classified by intensity. Primary endpoint was changes in acid-base balance at six hours. Secondary endpoints included ICU mortality. The association of intensity and ICU mortality was assessed using multivariable logistic regression analysis, adjusting for major confounders.
Results: We included 239 patients and classified into four groups: Very Low (<10ml/kg/hr, n=43), Low (10-20ml/kg/hr, n=144), Standard (20-30ml/kg/hr, n=22), and High (>30ml/kg/hr, n=28). Mean changes (SD) of acid-base balance at six hours were: pH, 0.03 (0.11), –0.01 (0.14), 0.04 (0.12), 0.07 (0.13); BE, 1.3 (3.7), –0.1 (5.5), 2.4 (4.7), 3.1 (6.5); SID, 1.3 (4.0), –0.1 (5.9), 1.7 (6.5), 0.5 (4.7). The adjusted odds ratios for ICU mortality were 0.07 (95% CI, 0.02-0.29) in Very Low, 0.10 (95%CI, 0.02-0.37) in Low, and 0.09 (95%CI, 0.02-0.41) in High, compared with Standard.
Conclusions: When CRRT was provided with low or very low intensity, pH and BE were corrected slower than standard or high-intensity CRRT. However, lower- intensity CRRT did not exhibit poor clinical outcomes. Randomized clinical trials are required to investigate the possible beneficial effect of low-intensity CRRT.

6-4

Timing of prophylactic antibiotic administration and signs of systemic infection in patients undergoing percutaneous biliary intervention

Hyunjae Im 1, Seung-Young Oh 1, Hye Young Woo 1, Leerang Lim 2, Hannah Lee 2, Ho Geol Ryu 1

1 Department of Critical Care Medicine, Seoul National University Hospital, Seoul National University College of Medicine
2 Department of Anesthesiology and Pain Medicine, Seoul National University Hospital, Seoul National University College of Medicine

Introduction: Percutaneous biliary intervention (PBI) could be accompanied by the high risk of post-procedure infection and sepsis because of the nature of the intervention targeting the bile duct. Although prophylactic antibiotics administration before the intervention is essential, current guidelines for antibiotic prophylaxis in interventional radiology were essentially based on surgical practice. We investigated the correlation between the timing of prophylactic antibiotics administration and the incidence of systemic infection after PBI.
Methods: A retrospective review was conducted for PBI performed at a single center between August 2020 and October 2021. The incidence of systemic infection after PBI was compared among three groups by different time intervals between prophylactic antibiotics administration and skin puncture time for PBI. Systemic infection that occurred after PBI was assessed according to predetermined clinical criteria. To identify independent risk factors of systemic infection after PBI, univariable and multivariable logistic regression analyses were conducted.
Results: Of the 488 PBIs, 79 cases (16.2%) developed a systemic infection. Compared with procedures with antibiotic administration within 60 minutes prior to PBI, higher systemic infection rates were observed for timing more than 180 minutes prior to the intervention (unadjusted odds ratio [OR] = 8.53; 95% confidence interval [CI], 1.15-63.25). In a multivariable analysis adjusted for comorbidities, indication for PBI, type of intervention, and antibiotic variables, a time interval of more than 180 minutes between prophylactic antibiotics administration and PBI was associated with frequent systemic infection after the intervention (adjusted OR = 7.95; 95% CI, 1.04-60.61).
Conclusions: Administration of prophylactic antibiotics more than 3 hours before PBI is an independent risk factor for systemic infection after the intervention. As with current guidelines, it is recommended to administer prophylactic antibiotics within one hour of the initiation of PBI.

Table 1. Criteria for signs of systemic infection

Systemic infection if meeting two or more of the followings	
Hypotension	The lowest SBP ≤ 80 mmHg or needs for vasopressors or fluid resuscitation
Fever	The highest BT ≥ 38 ℃ or administration of antipyretics
Tachypnea	The fastest RR ≥ 22 / min
Tachycardia	The fastest HR ≥ 100 beats/min
Altered mentality	The worst GCS < 15 or record about the altered mentality
Systemic infection after percutaneous biliary intervention if meeting two or more of the followings (If each variable was positive before the intervention)	
Hypotension	20% or lower than the lowest SBP before the intervention or add vasopressors or increasing dose of vasopressors or additional fluid resuscitation
Fever	1 ℃ or higher than the highest BT before the intervention or administration of additional antipyretics
Tachypnea	4 / min or faster than the fastest RR before the intervention
Tachycardia	20% or faster than the fastest HR before the intervention
Altered mentality	Worsen GCS than before the intervention or newly developed altered mentality

SBP: systolic blood pressure, BT: body temperature, RR: respiratory rate, HR: heart rate, GCS: Glasgow Coma Scale

Table 2. Baseline characteristics

	Time intervals (min)			
	< 1 hour	1 - 3 hours	≥ 3 hours or no prophylaxis	*p*
Total	39	89	360	
Demographic				
Age	67.2 ± 11.7	65.7 ± 12.8	67.6 ± 11.0	0.363
Male sex	25 (64.1%)	59 (66.3%)	230 (63.9%)	0.914
BMI (kg/m^2)	25.2 ± 3.6	23.6 ± 3.2	23.5 ± 3.2	0.005
Comorbidities				
Hypertension	9 (23.1%)	26 (29.2%)	125 (34.7%)	0.247
Diabetes	14 (35.9%)	31 (34.8%)	100 (27.8%)	0.290
COPD	1 (2.6%)	2 (2.2%)	2 (0.6%)	0.223
Coronary artery disease	3 (7.7%)	8 (9.0%)	25 (6.9%)	0.801
Congestive heart failure	0 (0.0%)	2 (2.2%)	2 (0.6%)	0.239
Chronic kidney disease	0 (0.0%)	6 (6.7%)	26 (7.2%)	0.223
Chronic liver disease	10 (25.6%)	16 (18.0%)	38 (10.6%)	0.010
Post-liver transplant status	11 (28.2%)	24 (27.0%)	25 (6.9%)	<0.001
Malignancy around biliary system[1]	28 (71.8%)	50 (56.2%)	250 (69.4%)	0.047
Indication for biliary intervention				0.093
Malignant biliary stenosis	17 (43.6%)	34 (38.2%)	190 (52.8%)	
Cholangitis with CBD stone	7 (17.9%)	18 (20.2%)	51 (14.2%)	
Acute cholecystitis	6 (15.4%)	14 (15.7%)	67 (18.6%)	
Biliary stenosis after anastomosis	5 (12.8%)	13 (14.6%)	18 (5.0%)	
Biliary abscess or biloma	2 (5.1%)	3 (3.4%)	14 (3.9%)	
Biliary leakage	2 (5.1%)	4 (4.5%)	10 (2.8%)	
Other biliary stenosis or cholangitis	0 (0.0%)	3 (3.4%)	10 (2.8%)	
Antibiotic therapy before intervention	27 (69.2%)	67 (75.3%)	211 (58.6%)	0.010
Immunosuppressive drugs	12 (30.8%)	23 (25.8%)	32 (8.9%)	<0.001
Type of biliary intervention				0.426
PTBD	25 (64.1%)	60 (67.4%)	250 (69.4%)	
Cholecystostomy	8 (20.5%)	16 (18.0%)	78 (21.7%)	
Biliary stone extraction	6 (15.4%)	13 (14.6%)	32 (8.9%)	

Data are presented as mean ± standard deviation or number (percentage).

[1]Malignancy around biliary tracts such as liver, bile duct, and pancreas head

BMI: body mass index, COPD: chronic obstructive pulmonary disease, CBD: common bile duct, PTBD; percutaneous transhepatic biliary drainage

Table 3. The incidence of signs of systemic infection and detailed criteria by the time interval between prophylactic antibiotics administration and percutaneous biliary intervention

	Time intervals (min)			
	< 1 hour	1 - 3 hours	≥ 3 hours or no prophylaxis	*p*
Total	39	89	360	
Signs of systemic infection[1]	1 (2.6%)	12 (13.5%)	66 (18.3%)	0.030
Hypotension	1 (2.6%)	4 (4.5%)	24 (6.7%)	0.480
Fever	3 (7.7%)	23 (25.8%)	95 (26.4%)	0.036
Tachypnea	3 (7.7%)	8 (9.0%)	30 (8.3%)	0.967
Tachycardia	2 (5.1%)	12 (13.5%)	50 (13.9%)	0.304
Mental change	1 (2.6%)	3 (3.4%)	16 (4.4%)	0.793
Culture was performed	5	26	71	
Identification of pathogen	0 (0.0%)	8 (30.8%)	25 (35.2%)	0.261

Data are presented as numbers (percentage).

[1]Systemic infection if meeting two or more of the following

Table 4. Univariable and multivariable logistic regression analyses for signs of systemic infection after percutaneous biliary intervention

Variable	Univariable OR	*p*	Multivariable adjusted OR	*p*
Age (years)				
< 65	Reference			
≥ 65	1.11 (0.68 - 1.81)	0.678		
Sex				
Male	1.08 (0.65 - 1.79)	0.764		
BMI (kg/m²)				
< 30	Reference			
≥ 30	0.86 (0.25 - 2.98)	0.809		
Comorbidities				
Hypertension	1.50 (0.91 - 2.45)	0.112	1.13 (0.65 - 1.96)	0.672
Diabetes	0.90 (0.53 - 1.53)	0.692		
COPD	1.30 (0.14 - 11.8)	0.817		
Coronary artery disease	1.82 (0.82 - 4.03)	0.141	1.33 (0.54 - 3.31)	0.536
Congestive heart failure	1.74 (0.18 - 16.90)	0.635		
Chronic kidney disease	2.55 (1.16 - 5.62)	0.020	1.83 (0.76 - 4.36)	0.176
Chronic liver disease	1.09 (0.54 - 2.19)	0.816		
Post-liver transplant status	0.44 (0.17 - 1.12)	0.086	0.76 (0.15 - 3.91)	0.740
Malignancy around bile duct	0.87 (0.52 - 1.44)	0.583		
Indication for biliary intervention				
Malignant biliary stenosis[1]	Reference		Reference	
Cholangitis with CBD stone	0.80 (0.35 - 1.82)	0.589	0.79 (0.28 - 2.29)	0.667
Acute cholecystitis	3.22 (1.79 - 5.78)	<0.001	1.56 (0.50 - 4.83)	0.441
Biliary stenosis after anastomosis	1.09 (0.40 - 3.02)	0.864	1.66 (0.49 - 5.63)	0.417
Biliary abscess/biloma	1.27 (0.35 - 4.61)	0.716	1.08 (0.27 - 4.35)	0.915
Biliary leakage	0.97 (0.21 - 4.46)	0.966	0.90 (0.19 - 4.40)	0.900
Other biliary stenosis or cholangitis	1.23 (0.26 - 5.82)	0.793	0.89 (0.18 - 4.47)	0.885
Antibiotic therapy before intervention	1.19 (0.72 - 1.97)	0.506		
Immunosuppressive drugs	0.57 (0.25 - 1.29)	0.175	0.77 (0.20 - 3.06)	0.714
The time interval between prophylactic antibiotics administration and the intervention				
0 - 1 hour	Reference		Reference	
1 - 3 hours	5.92 (0.74 - 47.25)	0.093	5.51 (0.67 - 45.09)	0.111
> 3 hours	8.53 (1.15 - 63.25)	0.036	7.95 (1.04 - 60.61)	0.045
Type of intervention				
PTBD	Reference		Reference	
Cholecystostomy	2.97 (1.75 - 5.04)	<0.001	1.51 (0.53 - 4.32)	0.447
Biliary stone extraction	0.74 (0.28 - 1.96)	0.542	1.04 (0.30 - 3.67)	0.949
Septic condition before the intervention	1.92 (1.15 - 3.19)	0.012	1.33 (0.75 - 2.35)	0.333
The maintenance of antibiotics therapy after the intervention	4.70 (1.44 - 15.36)	0.010	3.57 (1.05 - 12.21)	0.042

Data are presented as odds ratio (95% confidence interval).

[1]Malignancy around biliary tracts such as liver, bile duct, and pancreas head

BMI: body mass index, COPD: chronic obstructive pulmonary disease, CBD: common bile duct, OR; odd ratio, PTBD; percutaneous transhepatic biliary drainage

Hosmer-Lemeshow test for goodness of fit for multivariable logistic regression model: c2 = 2.267, degrees of freedom = 8, $p = 0.972$

6-5

Albumin is a Simple and Useful Indicator for the Occurrence of Delirium in Patients Admitted to the Cardiac Intensive Care Unit

Tae Wan Kim 1 ; Ryoung-Eun Ko 1 ; Jeong Hoon Yang 1, 2

1 Department of Critical Care Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
2 Division of Cardiology, Department of Medicine, Heart Vascular Stroke Institute, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Background: Malnutrition was related to development of delirium which is associated with clinical outcomes in patients admitted to the intensive care unit. However, limited data are available on the association of nutritional indices with the development of delirium in cardiac intensive care unit (CICU). Thus, we aimed to analyze whether the nutritional indices can predict the development of delirium in CICU.
Methods: We enrolled 2,783 patients admitted to the CICU of Samsung Medica Center for more than 24 hours between September 2012 and December 2018. We assessed the nutritional status at admission using three nutritional indices Geriatric Nutritional Risk Index (GNRI), Prognostic Nutrition Index (PNI), and Controlling Nutritional Status (CONUT) and compared predictive performances for the development of delirium among nutritional indices using Delong's test.
Results: Delirium was developed in 678 patients (24.3%) when patients were assessed three times daily until seven days of ICU stay. Nutritional indices had fair predictive performances of the development of delirium in patients with critically-ill cardiovascular disease with areas under the receiver-operating characteristic curve (AUROC: 0.729 for the GNRI, 0.728 for PNI and 0.762 for CONUT). Furthermore, The AUROC of was significantly greater for albumin alone (0.77, 95% CI, 0.75-0.79) compared to GNRI (P<0.001) and PNI (P<0.001). In multivariable analysis including each component of nutritional indices, albumin was significant predictor for the occurrence of delirium but not absolute lymphocyte count, body weight/ideal body weight, and total cholesterol level.
Conclusions: Predictive performances of nutritional indices for the development of delirium were acceptable in patients admitted to CICU. In particular, albumin alone may be a simple and useful indicator for the development of delirium because its predictive performance was not inferior to preexisting nutritional indices.

6-6

Adherence to the lung-protective ventilation strategy in Asian intensive care units

Shinichiro Ohshimo1, Kyung Hun Nam2, Younsuck Koh3; the IMPROVE study investigators

1. Department of Emergency and Critical Care Medicine, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan
2. Department of Critical Care Medicine, Seongnam Citizens Medical Center, Seongnam, South Korea
3. Department of Pulmonary and Critical Care Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea

Introduction: In Asian intensive care units (ICUs), many patients are managed with invasive mechanical ventilation, but no studies have evaluated the adherence to lung-protective mechanical ventilation (LPV) strategies. The aim of this study was to investigate the practical patterns of each component of LPV and to evaluate the adherence to the LPV strategy in Asian ICUs.

Methods: A multicenter, cross-sectional study was conducted involving 190 ICUs in 17 Asian countries. We evaluated compliance with the LPV strategy (low tidal volume ventilation, low plateau pressure, and optimal positive end-expiratory pressure) in patients undergoing invasive mechanical ventilation. We also evaluated the association between predictors of LPV compliance and mortality.

Results: Of the 1,408 patients enrolled, adherence with low tidal volume ventilation, low plateau pressure, and optimal positive end-expiratory pressure was 87%, 95%, and 73%, respectively. Of all subjects, 953 (68%) were compliant with the LPV strategy (41% in ARDS and 70% in non-ARDS). Adherence to the LPV strategy was associated with teaching hospitals (odds ratio [OR] 2.05, $p<0.001$), non-medical ICUs (OR 1.69, $p=0.004$), number of ICU beds (OR 0.99, $p=0.023$), regular rounds by intensivists (OR 2.24, $p=0.021$), and presence of duty physicians (OR 1.51, $p=0.030$). A higher rate of LPV compliance was associated with a lower mortality rate (OR 0.62, $p=0.007$). Income level, age, SOFA score, PaO2/FIO2 ratio, corticosteroid use, and number of vasoactive drugs were also associated with mortality.

Conclusions: In Asian ICUs, low volume ventilation and low plateau pressure were widely used. However, compliance with all components of the LPV strategy was still low, especially in patients with ARDS. The income level of each country was not associated with LPV compliance, but was independently associated with mortality.