



**PPTC**  
Pan-Pacific Trauma Congress

*"Go Together"*



# PPTC 2019

**7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea**  
**34<sup>th</sup> Annual Meeting of Korean Society of Traumatology**

**April 4(Thu) - 6(Sat), 2019**  
**Militopia Hotel, Seongnam, Korea**



# WELCOME MESSAGE

## (Korean Society of Traumatology)



It is my honor to welcome all of you from around the world to the 7th Pan-pacific trauma congress which will be held in Seongnam, Korea, from April 4th to 6th, 2019

The level of care for trauma patients can be a measure of national health, and many countries support such as the establishment of trauma centers and the support of the trauma specialists. The level of trauma care in Korea is also being developed with national support and cooperation with Armed forces medical command. But we have a lot of things to do to improve the care level of the trauma patients.

To improve and develop the quality level of the trauma care, the members of the group have moved away from self-centered thinking, discussed and collaborated with spirit of dedication and sacrifice. So the level of trauma care is developing continuously, even though slowly.

Therefore, we hope that the 7th Pan-pacific trauma congress will be a place for sharing the experiences of various trauma specialists from each country on various topics, and for exchanging knowledge on research, education, medical skills, and the construction of a trauma system, as well as establish a network of new knowledge of trauma care

I wish Pan-pacific trauma congress will be a festival for everyone

Best wishes

**Sung-Hyuk Choi**

President of Koean Society of Traumatology

## WELCOME MESSAGE (Armed Forces Medical Command)



I would like to extend my warm welcome to all who have visited to participate in the 7th Pan-Pacific Trauma Congress. I would also wish to express my gratitude to everyone who helped prepare for this event, including Mr. Sung-Hyeok Choi, the Chairman of the Korean Society of Traumatology, and to the co-hosting committee.

The Armed Forces Medical Command is putting in a huge amount of effort to reinforce its trauma care capacity by organizing joint symposiums and by co-hosting the Pan-Pacific Trauma Congress. This was all made possible through the mutual relationship with the Korean Society of Traumatology. As a result of these efforts, trauma experts have enhanced our nation's position through various forms of medical support at the 2018 Pyeongchang Winter Olympic Games. The Armed Forces Trauma Center is also expected to become operational by 2020, which will allow the Armed Forces Medical Command to revolutionize trauma care in the military and to play a huge role in the advancement of trauma care in the civilian sector.

I believe that this year's Pan-Pacific Trauma Congress will be a good chance for both the Armed Forces Medical Command and the Korean Society of Traumatology. It will allow the two facilities to accomplish common goals and to reinforce mutual relationship. Trauma experts from more than 7 countries are expected to participate this year, which will hopefully lead to active discussion.

It is my hope that the Congress will continue to develop through the years, and that this will lead to a stronger relationship between the two facilities.

**Woong Seog**

Brigadier General

Commanding General of The Armed Forces Medical Command

## ORGANIZATION

### ❑ Korean Society of Traumatology (KST)

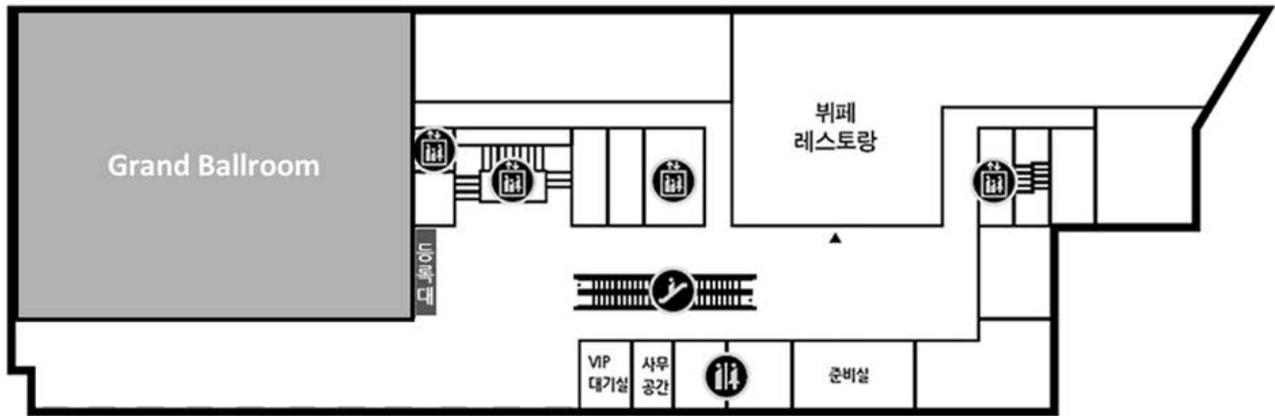
President	Sung Hyuk Choi (Korea University)
Chairman of Board of Directors	Hyun Min Cho (Pusan National University)
Secretary General	Chan Yong Park (Wonkwang University)
Director of Scientific Program Committee	Young Ho Lee (Seoul National University)
Director of Registration Committee	Keum Seok Bae (Yonsei University Wonju College of Medicine)
Director of Information Committee	Oh Hyun Kim (Yonsei University Wonju College of Medicine)
Director of International Liaison Committee	Kyung Hag Lee (National Medical Center)
Director of External Cooperation Committee	Hwan Jun Jae (Seoul National University)
Director of Public Relations Committee	Sung Youl Hyun (Gachon University)

### ❑ Armed Forces Medical Command (AFMC)

Co-President	BG Woong Seok
Advisor	BG Byung Seop Choi
Secretary General	COL Beomman Ha
Director of Scientific Program Committee	COL Sang Ho Lee
Director of Registration Committee	LTC Jiseok Kang
Director of Public Relations	COL Seung Hwan Pyun
Director of International Liaison Committee	COL Chae Hyuk Lee

## FLOOR PLAN

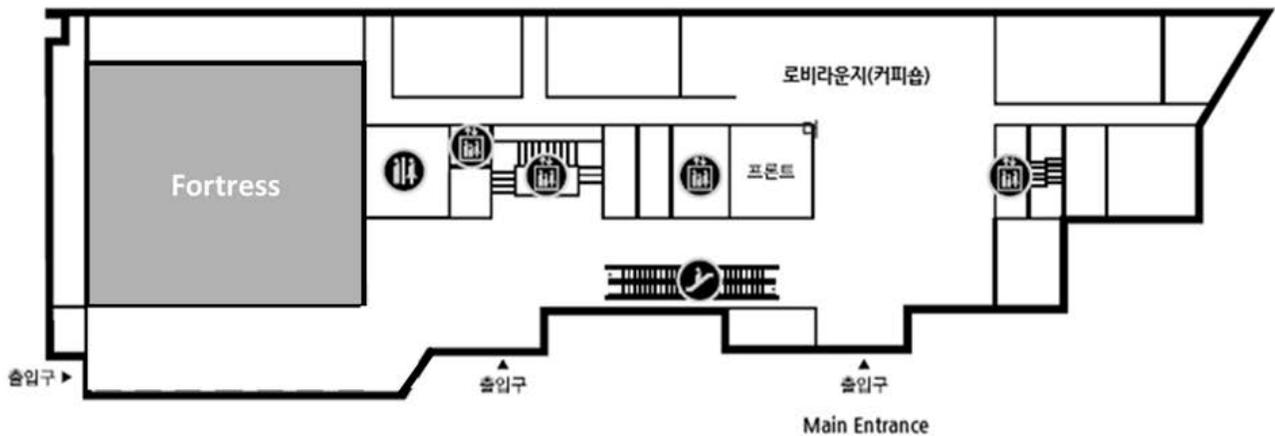
### 2F Grand Ballroom



**2F** Grand Ballroom (Room 1)  
 Registration Desk  
 Preview Room  
 VIP Room  
 The Buffet

**1F** Fortress (Room 2)  
 Poster Exhibition

### 1F Fortress



# PROGRAM

**Friday 5 April 2019**

TIME	Grand Ballroom (2nd Floor)	TIME	Fortress (1st Floor)
08:20-08:45	Registration		
08:45-09:00	Opening Ceremony		
	<b>Opening Address:</b> <i>Hyun Min Cho (Chairman, Board of Directors of KST)</i>		
	<b>Congratulatory Address:</b> <i>Sung Hyuk Choi (President of KST)</i> <i>Woong Seog (Armed Forces Medical Commander, Korea)</i> <i>Akio Kimura (CEO, Board of Directors of JAST)</i>		
09:00-10:00	<b>Session I: Military Session (Oral 1)</b>	09:00-10:00	<b>Session II: Paramedic Session (Education 1)</b>
	<b>Session director: Giho Moon (Armed Forces Capital Hospital, Korea)</b>		<b>Session director: Jundong Moon (Kongju National University, Korea)</b>
	Moderator 1: Ki Chul Park (Hanyang Universty, Korea)		Moderator 1: Beomman Ha (Armed Forces Medical Command, Korea)
	Moderator 2: Seung Hwan Pyun (Armed Forces Medical Command, Korea)		Moderator 2: Younghoon Yoon (Korea University, Korea)
09:00-09:15	Oral1-1 Introduction of military EMS development <i>Daehyun Kang (Armed Forces Capital Hospital, Korea)</i>	09:00-09:15	Fluid resuscitation and shock management <i>Eunjoo Kwag (Daewon University, Korea)</i>
09:15-09:30	Oral1-2 Penetrating abdominal injury <i>Hojun Lee (Armed Forces Capital Hospital, Korea)</i>	09:15-09:30	Revised GCS and traumatic brain injury <i>Sieun Park (Donggang University, Korea)</i>
09:30-09:45	Oral1-3 Traumatic lower extremity amputation <i>Giho Moon (Armed Forces Capital Hospital, Korea)</i>	09:30-09:45	Spinal motion restriction and transfer to definite care <i>Anjie Yoo (United States Forces, Korea)</i>
09:45-10:00	Oral1-4 Epidemiology of Traumatic Spinal Cord Injury in Korean Military <i>Jeong-Gil Kim (Armed Forces Daejeon Hospital, Korea)</i>	09:45-10:00	Traumatic cardiac arrest <i>Jundong Moon (Kongju National University, Korea)</i>
10:00-11:00	<b>Plenary Session I (English session): Beyond Trauma (I)</b>		
	<b>Session director: Young Ho Lee (Seoul National University, Korea)</b>		
	<b>ENG</b> Moderator 1: Hyun Min Cho (Pusan National University, Korea)		
	Moderator 2: Choi Byung Seop (Headquarters of ROK Army, Korea)		
	10:00-10:20 <b>ENG</b> What will happen in the future of the Korean society of traumatology <i>Sung Hyuk Choi (President of KST)</i>		
10:20-10:40 <b>ENG</b> Vision of Military Aeromedical Evacuation <i>Jong Ha Moon (Armed Forces Medical Command, Korea)</i>			
10:40-11:00 <b>ENG</b> Perspective for qualification of trauma expert in Japan <i>Akio Kimura (CEO, Board of Directors of JAST)</i>			
11:00-11:30	Coffee Break / Poster-Oral Presentation		
11:30-12:30	<b>Plenary Session II (English session): Beyond Trauma (II)</b>		
	<b>Session director: Young Ho Lee (Seoul National University, Korea)</b>		
	<b>ENG</b> Moderator 1: Kang Hyun Lee (Yonsei University Wonju College of Medicine, Korea)		
11:30-12:00	Moderator 2: Chang Won Kim (Pusan National University, Korea)		
	Non-incremental innovation for combat casualty care: Manned and Unmanned Evacuation for Polytrauma Treated with Point-of-need Mobile Heparin-free Extracorporeal Life Support <i>Andriy I Batchinsky (The Geneva Foundation / US Army Institute of Surgical Research)</i>		
12:00-12:30 <b>ENG</b>	Trauma management system in USA <i>Andre Uflacker (University of Virginia, USA)</i>		

## Friday 5 April 2019

TIME	Grand Ballroom (2nd Floor)		TIME	Fortress (1st Floor)	
12:30-13:30	Luncheon - Banquet / ACT meeting - The Buffet (2F), Sapphire Hall				
13:30-14:30	<b>Session III: Imaging &amp; Intervention (Oral 2)</b>		13:30-14:30 <b>ENG</b>	<b>Korea-Japan Symposium I (English session): Bench to Bedside (Oral 3)</b>	
	<b>Session director: Chang Ho Jeon (Pusan National University, Korea)</b>			<b>Session director: Kyung Hag Lee (National Medical Center, Korea)</b>	
	Moderator 1: Sung Youl Hyun (Gachon University, Korea)			Moderator 1: Keum Seok Bae (Yonsei University Wonju College of Medicine)	
	Moderator 2: Chang Won Kim (Pusan National University, Korea)			Moderator 2: Mizobata Yasumitsu (Osaka City University, Japan)	
13:30-13:50	Keynote	Direction of diagnostic and interventional radiology in trauma <i>Chang Won Kim (Pusan National University, Korea)</i>	13:30-13:42 <b>ENG</b>	Oral 3-1	Exosomes as mediators of immune-inflammatory responses after severe trauma <i>Mitsuaki Kojima (Tokyo Medical and Dental University, Japan)</i>
13:50-13:58	Oral 2-1	Transarterial Embolization in the External Carotid Artery for Head and Neck Trauma: An Experience from a Level I Trauma Center <i>Lee Hwangbo (Pusan National University Hospital)</i>	13:42-13:54 <b>ENG</b>	Oral 3-2	Establishment and utilization of Korea in-depth accident study data base <i>Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)</i>
13:58-14:06	Oral 2-2	Experience of In house interventional Radiologist as a Trauma Team Activation Member <i>Sungnam Moon (Wonkwang university hospital)</i>	13:54-14:06 <b>ENG</b>	Oral 3-3	High-dose FXIII administration is a promising treatment option for trauma-associated coagulopathy <i>Futoshi Nagashima (Saga University, Japan)</i>
14:06-14:14	Oral 2-3	Traumatic Aortic Injury: Clinical Results of Endovascular Repair, 4-years Experiences in a Single Regional Trauma Center <i>Chang Ho Jeon (Pusan National University Hospital)</i>	14:06-14:18 <b>ENG</b>	Oral 3-4	Speed of fluid does matter <i>Kyuseok Kim (Seoul National University, Korea)</i>
14:14-14:22	Oral 2-4	Inner ear problems in patients with blunt head trauma <i>Ji Eun Choi (Dankook university hospital)</i>	14:18-14:30 <b>ENG</b>	Oral 3-5	The randomized multicenter controlled trial for preoperative early-induced hypothermia and its scientific rationale <i>Shoji Yokobori (Nippon Medical School, Japan)</i>
14:22-14:30	Oral 2-5	Comparison of the MRI and operation waiting times in traumatic cervical spinal cord injury; with or without radiological abnormality, does it differ? <i>Jeong Heo (Kyungpook National University Hospital)</i>			
14:30	[KST - KSPRS MOU] - Grand Ballroom				
14:30-15:30	<b>Session IV: Polytrauma - Facial Bone Fracture (Education 2)</b>		14:30-15:30 <b>ENG</b>	<b>International Session I (English session): Asian Collaboration on Trauma (I) (Education 3)</b>	
	<b>Session director: Dong Hee Kang (Dankook University, Korea)</b>			<b>Session director: Chan Yong Park (Wonkwang University, Korea)</b>	
	Moderator 1: Yong Ha Kim (Yeungnam University, Korea)			Moderator 1: Jae Baek Lee (Jeonbuk National University, Korea)	
	Moderator 2: Kwang Seog Kim (Chonnam National University, Korea)			Moderator 2: Takashi Fujita (Teikyo University, Japan)	
14:30-14:45		The role of plastic surgery in trauma centers <i>Hi Jin You (Korea University, Korea)</i>	14:30-14:45 <b>ENG</b>		Trauma System in Cambodia <i>Sok Buntha (University of Health Sciences, Cambodia)</i>
14:45-15:00		Craniofacial trauma at regional emergency centers <i>Young Joon Jun (The Catholic University, Korea)</i>	14:45-15:00 <b>ENG</b>		Investigating the mechanism of injury in road traffic accidents: "in depth study" with engineers <i>Mototsugu Kohno (Tsukuba Medical Center Hospital, Japan)</i>
15:00-15:15		Team surgery with plastic surgeon at emergency center <i>Dong Hee Kang (Dankook University, Korea)</i>	15:00-15:15 <b>ENG</b>		Early experiences and outcomes of physician-bases ground transportation <i>Kyu Hyouck Kyoung (University of Ulsan, Korea)</i>
15:15-15:30		Plastic surgery participation plan at the regional trauma center <i>Nam Kyu Lim (Dankook University, Korea)</i>	15:15-15:30 <b>ENG</b>		3-in-1 Hong Kong protocol in management of haemodynamically unstable pelvic fractures <i>Cheng Mina (Queen Elizabeth Hospital, Hong Kong)</i>
15:30-16:00	Coffee Break / Poster-Oral Presentation				
16:00-17:00	<b>Session V: Role of Korea Centers of Disease Control and Prevention (Education 4)</b>		16:00-17:00 <b>ENG</b>	<b>International Session II (English session): Intervention for Penetrating Injury (Education 5)</b>	
	<b>Session director: Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)</b>			<b>Session director: Chang Ho Jeon (Pusan National University, Korea)</b>	
	Moderator 1: Sang Do Shin (Seoul National University, Korea)			Moderator 1: Hwan Jun Jae (Seoul National University, Korea)	
	Moderator 2: Seok Ran Yeom (Pusan National University, Korea)			Moderator 2: Sung Wook Chang (Dankook University, Korea)	
16:00-16:20		Clinical application and quality management of emergency department-based injury in-depth surveillance data <i>Sung Ok Hong (Korea Centers of Disease Control and Prevention, Korea)</i>	16:00-16:30 <b>ENG</b>		Management for gunshot wound focusing on intervention <i>Eli Atar (Rabin Medical Center, Israel)</i>

## Friday 5 April 2019

TIME	Grand Ballroom (2nd Floor)	TIME	Fortress (1st Floor)
16:20-16:40	Past progress and future improvement of EMS-assessed severe trauma / mass casualty incident database <i>Kyoung-Jun Song (Seoul National University, Korea)</i>	16:30-16:50 <b>ENG</b>	Endovascular intervention in penetrating injury <i>Yosuke Matsumura (Chiba University Graduate School of Medicine, Japan)</i>
16:40-17:00	Pan Asia Trauma Outcomes Study <i>Sang Do Shin (Seoul National University, Korea)</i>	16:50-17:00 <b>ENG</b>	Q & A
17:00-18:00	<b>Session VI: Role of Nurse in Trauma (Education 6)</b>	17:00-18:00 <b>ENG</b>	<b>International Session III (English session): International Trauma Study (Education 7)</b>
	<b>Session director: Jeong Ok Park (Ajou University, Korea)</b>		<b>Session director: Chan Yong Park (Wonkwang University, Korea)</b>
	Moderator 1: Jeong Ok Park (Ajou University, Korea)		Moderator 1: Yang Bin Jeon (Gachon University, Korea)
	Moderator 2: Myoung Ran Yoo (Taegu Science University, Korea)		Moderator 2: Hang Ju Cho (Uijeongbu St. Mary's Hospital, Korea)
17:00-17:15	Role in trauma bay <i>Ji Young Kim (Pusan National University Hospital, Trauma ER, Korea)</i>	17:00-17:30 <b>ENG</b>	Keynote High mobility group box 1 protein in trauma 1) HMGB1 increases after pulmonary contusion in a combat-relevant polytrauma model 2) Expression of HMGB1 in a polytrauma model treated with ECLS at ground level and high altitude <i>Jae Hyek Choi (The Geneva Foundation / US Army Institute of Surgical Research)</i>
17:15-17:30	Role in operation room <i>Je Yung Mun (Ajou University Hospital, Trauma OR, Korea)</i>		
17:30-17:45	Role in trauma ICU <i>Bo Kyung Kim (Wonju Severance Christian Hospital, Trauma ICU, Korea)</i>	17:30-17:45 <b>ENG</b>	Management of Trauma in austere environment-Experience in Sri Lanka <i>Kamal Jayasuriya (College of Surgeons, Sri Lanka)</i>
17:45-18:00	Role in trauma ward <i>So Young Jung (Uijeongbu St. Mary's Hospital, Trauma Ward, Korea)</i>	17:45-18:00 <b>ENG</b>	Anesthesia for the trauma patient. Personal research (experimental and clinical) <i>Carlos L. Errando Oyonarte (Consorti Hospital General Universitari València, Spain)</i>

## Satday 6 April 2019

TIME	Grand Ballroom (2nd Floor)	TIME	Fortress (1st Floor)
08:00-09:00	Registration		
09:00-10:00	<b>Session VII: Quality Improvement (Education 8)</b>	09:00-10:00	<b>Session VIII: Polytrauma - Neurosurgery (Education 9)</b>
	<b>Session director: Byung Chul Yu (Gachon University, Korea)</b>		<b>Session director: Bo Ra Seo (Mokpo Hankook Hospital, Korea)</b>
	Moderator 1: Jung Nam Lee (Gachon University, Korea)		Moderator 1: Yeongdae Kim (Pusan National University, Korea)
	Moderator 2: Seok Ho Choi (Dankook University, Korea)		Moderator 2: Seong-Keun Moon (Wonkwang University, Korea)
09:00-09:20	Preventable death rate as a quality indicator <i>Gil Jae Lee (Gachon University, Korea)</i>	09:00-09:20	Perspectives from emergency physician <i>Hyun-Ho Ryu (Chonnam National University, Korea)</i>
09:20-09:40	Quality indicators in KTDB <i>Jong-Min Park (National Medical Center, Korea)</i>	09:20-09:40	Perspectives from trauma surgeon <i>Dong Hun Kim (Dankook University, Korea)</i>
09:40-10:00	Trauma QI - Ideal and reality Panel discussion	09:40-10:00	Perspectives from neurotrauma surgeon <i>Bo Ra Seo (Mokpo Hankook Hospital, Korea)</i>
10:00-11:00	<b>Session IX: Collaboration between Trauma Surgeon and Interventional Radiologist (Duet presentation) (Education 10)</b>	10:00-11:00 <b>ENG</b>	<b>International Session IV (English session): Asian Collaboration on Trauma (II) (Education 11)</b>
	<b>Session director: Chan Yong Park (Wonkwang University, Korea)</b>		<b>Session director: Chan Yong Park (Wonkwang University, Korea)</b>
	Moderator 1: Chae Hyuk Lee (Armed Forces Goyang Hospital, Korea)		Moderator 1: Nam-Ryeol Kim (Korea University, Korea)
	Moderator 2: Sang-woo Park (Konkuk University, Korea)	Moderator 2: Teo Li-Tserng (Tan Tock Seng Hospital, Singapore)	
10:00-10:10	Case I (Gachon University, Korea) <i>Min-A Lee, Jung Han Hwang</i>	10:00-10:15 <b>ENG</b>	Cardiac injury management for general surgeon <i>Narain Chotirosniramit (Chiang Mai University, Thailand)</i>
10:10-10:20	Case II (Kyungpook National University, Korea) <i>Kyoung Hoon Lim, Sang Yub Lee</i>	10:15-10:30 <b>ENG</b>	Introduction of basic studies on blast injury at National Defense Medical College in Japan <i>Daizoh Saitoh (National Defense Medical College, Japan)</i>

## Saturday 6 April 2019

TIME	Grand Ballroom (2nd Floor)		TIME	Fortress (1st Floor)	
10:20-10:30	Case III (Dankook University, Korea) <i>Ye Rim Chang, Min Jeong Choi</i>		10:30-10:45 <b>ENG</b>	Point-of-care endoscopic optical coherence tomography detects changes in mucosal thickness in ARDS due to smoke inhalation and burns <i>Jae Hyeok Choi (The Geneva Foundation / US Army Institute of Surgical Research)</i>	
10:30-10:40	Case IV (Pusan National University, Korea) <i>Gil Hwan Kim, Hoon Kwon</i>		10:45-11:00 <b>ENG</b>	Improving Trauma Care in Asia <i>Teo Li-Tserng (Tan Tock Seng Hospital, Singapore)</i>	
10:40-10:50	Case V (Wonkwang University, Korea) <i>Wu Seong Kang, Seong Nam Moon</i>				
10:50-11:00	Case VI (Andong Medical Group Hospital, Korea) <i>Seok Hwa Youn, Young Hwan Kim</i>				
11:00-11:30	Coffee Break / Poster-Oral Presentation				
11:30-12:30	<b>Session X: Torso (Oral 4)</b>		11:30-12:30 <b>ENG</b>	<b>Korea-Japan Symposium II (English session): Trauma Database (Oral 5)</b>	
	Session director: <b>Sung Wook Chang (Dankook University, Korea)</b>			Session director: <b>Kyung Hag Lee (National Medical Center, Korea)</b>	
	Moderator 1: Sang Ho Lee (Armed Forces Capital Hospital, Korea)			Moderator 1: Sung Hyuk Choi (President of KST)	
	Moderator 2: Hyo Yoon Kim (Andong Hospital, Korea)			Moderator 2: Daizoh Saito (National Defence Medical College, Japan)	
11:30-11:45	Keynote lecture	Surgical management of abdominal IVC injury <i>Dong Hun Kim (Dankook University, Korea)</i>	11:30-11:45 <b>ENG</b>	Oral 5-1	Improving the performance of trauma center using KTDB <i>Byungchul Yu (Gachon University, Korea)</i>
11:45-11:55	Oral 4-1	Clinical Practice Guideline for Major Trauma Patients <i>Gil Jae Lee (Gachon University College of Medicine, Korea)</i>	11:45-12:00 <b>ENG</b>	Oral 5-2	Overview of Japan Trauma Data Bank (JTDB) and our new findings based on JTDB over 15 years <i>Jun Oda (Tokyo Medical University, Japan)</i>
11:55-12:05	Oral 4-2	Effectiveness of hemostatic gauze use in preperitoneal pelvic packing for hemodynamic instability due to severe pelvic fracture <i>Ji Young Jang (Yonsei University Wonju College of Medicine, Korea)</i>	12:00-12:15 <b>ENG</b>	Oral 5-3	Deployment and utilization of database: DKUH trauma center experience <i>Ye Rim Chang (Dankook university, Korea)</i>
12:05-12:15	Oral 4-3	Resuscitative thoracotomy to REBOA, laparotomy to angioembolization: A successful conversion strategy in a case of fall injury with pelvic fracture and liver injury <i>Ryoyu Hayashi (Chiba University, Japan)</i>	12:15-12:30 <b>ENG</b>	Oral 5-4	Establishing clinical evidence from the big data: Challenges by the Japan Trauma Databank investigators <i>Atsushi Shiraishi (Kameda Medical Center, Japan)</i>
12:15-12:25	Oral4-4	Initial results of Essential Surgical Procedures in Trauma(ESPIIT) for five years <i>Pil Young Jung (Wonju Severance Christian Hospital, Korea)</i>			
12:30-13:30	Luncheon / Korea - Japan leadership meeting - The Buffet (2F), Sapphire Hall		12:30-13:30	Luncheon	
13:30-14:30	<b>Session XI: Burn (Education 12)</b>		13:30-14:30	<b>Session XII: Polytrauma-Orthopedic Surgery (Education 13)</b>	
	Session director: <b>Oh Sang Kwon (Cheju Halla General Hospital, Korea)</b>			Session director: <b>Kyung Hag Lee (National Medical Center, Korea)</b>	
	Moderator 1: Yong Suk Cho (Hallym University Hangang Sacred Heart Hospital, Korea)			Moderator 1: Jong Keon Oh (Korea University, Korea)	
	Moderator 2: Hyun Chul Kim (Armed Forces Capital Hospital, Korea)			Moderator 2: Bo Ra Seo (Mokpo Hankook Hospital, Korea)	
13:30-13:45		Initial management and fluid resuscitation for burned patients <i>Yang Hyeong Tae (Hwachanghan Surgery Clinic, Korea)</i>		Case discussion	Orthopedic injury with neurotrauma-A Polytrauma patients-Multidisciplinary team approach matters
13:45-14:00		Assessment and management for burn wound <i>Yong Suk Cho (Hallym University Hangang Sacred Heart Hospital, Korea)</i>		Presenter	Jae Woo Cho (Korea University, Korea), Haewon Roh (Korea university, Korea)
14:00-14:15		Characteristics of burn patients in Jeju island and role of trauma center without burn center <i>Oh Sang Kwon (Cheju Halla General Hospital, Korea)</i>		Panel:	Yong-Cheol Yoon (Gachon University), Jung-Ho Yun (Dankook University), Young Hwan Kim (National Medical Center), Sung Wook Chang (Dankook University)
14:15-14:30		The characteristic features of burns in military hospital <i>Hyun Chul Kim (Armed Forces Capital Hospital, Korea)</i>			

## Saturday 6 April 2019

TIME	Grand Ballroom (2nd Floor)		TIME	Fortress (1st Floor)	
14:30-15:30	<b>Session XIII: Critical Care (Oral 6)</b>		14:30-15:30	<b>Session XIV: Emergency Medicine (Oral 7)</b>	
	Session director: Young Ho Lee (Seoul National University, Korea)			Session director: Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)	
	Moderator 1: Jung Chul Kim (Chonnam National University, Korea)			Moderator 1: Han Joo Choi (Dankook University, Korea)	
	Moderator 2: Jin Young Park (Kyungpook National University, Korea)			Moderator 2: Jin Sung Cho (Gachon University, Korea)	
14:30-14:45	Keynote	Parenteral nutrition in trauma patients <i>Hyo Jung Park (Samsung Medical Center, Korea)</i>	14:30-14:45	Keynote	True or false: Fast facts about the trauma <i>Wook-jin Choi (University of Ulsan, Korea)</i>
14:45-14:55	Oral 6-1	Utility of quick SOFA and quick SOFA plus lactate to predict 24 hour mortality in patients with severe trauma <i>Il Jae Wang (Pusan National University Hospital, Korea)</i>	14:45-14:55	Oral 7-1	Initial results of brand new Korea Trauma Assessment and Treatment Course(KTAT) <i>Pil Young Jung (Wonju Severance Christian Hospital, Korea)</i>
14:55-15:05	Oral 6-2	Clinical Significance of Malnutrition Risk in Severe Trauma Patients: A Single Center Study <i>Ho Hyun Kim (Pusan National University Hospital, Korea)</i>	14:55-15:05	Oral 7-2	The mortality benefit of trauma patients transferred directly to the trauma center in a regional trauma system in Korea <i>Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)</i>
15:05-15:15	Oral 6-3	The Effect of Vitamin D Supplementation in Acute Traumatic Brain injury Patients <i>Jong Min Lee (University of Ulsan College of Medicine, Korea)</i>	15:05-15:15	Oral 7-3	Outcomes of Physician-based Ground transportation in seriously injured trauma patient: A 2-year experience <i>Seongho Choi (Ulsan University Hospital, Korea)</i>
15:15-15:25	Oral 6-4	Prediction of survival with modified shock index in chest trauma patients <i>Do Wan Kim (Chonnam National University Hospital, Korea)</i>	15:15-15:25	Oral 7-4	Protective effect of helmet use on cervical injury in motorcycle crashes: A case-control study <i>Hae-Ju Lee (Chungbuk National University Hospital, Korea)</i>
15:30-16:00	Coffee Break				
16:00-17:00	General Assembly (Korean Society of Traumatology)				

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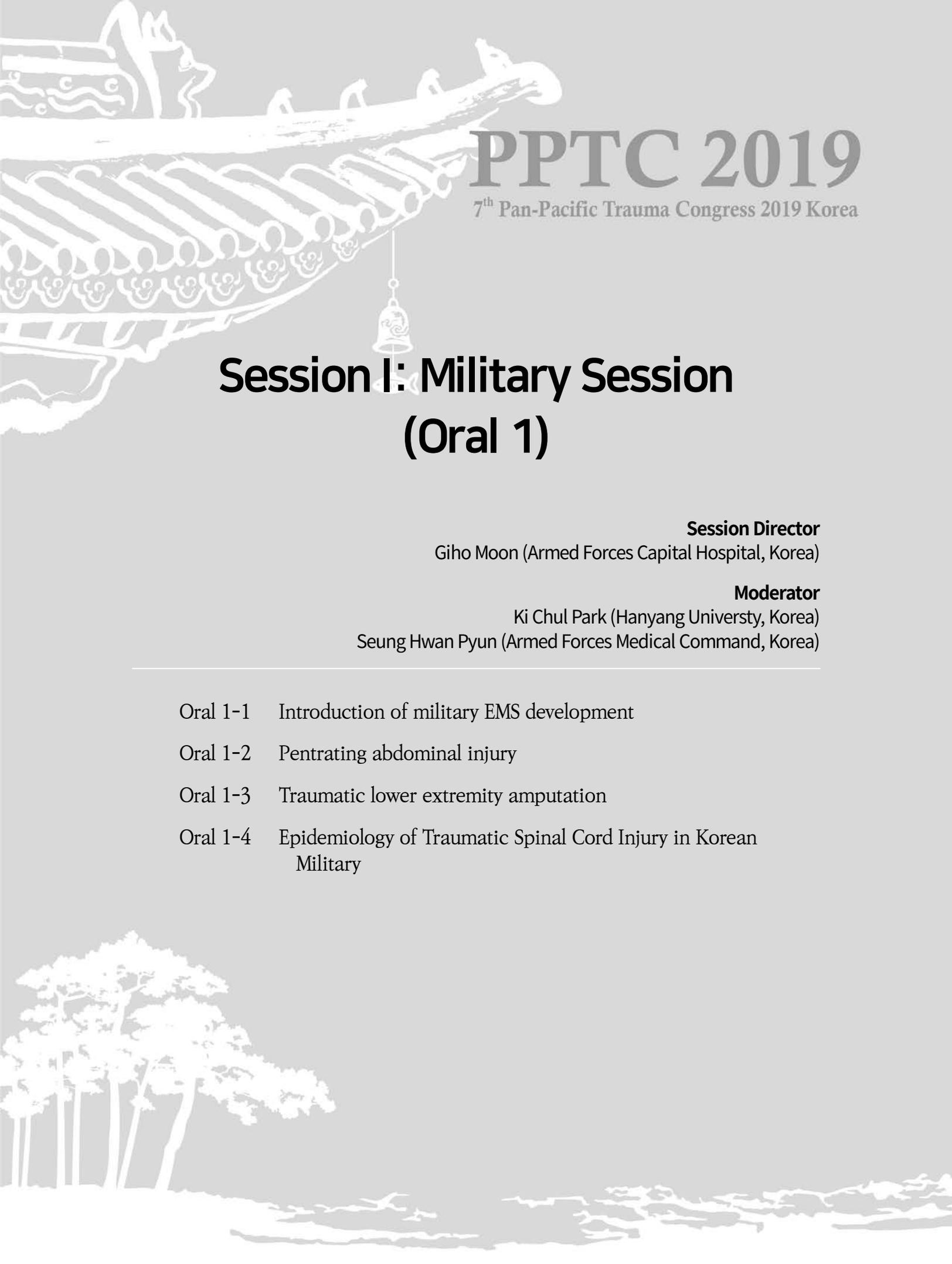
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# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session I: Military Session (Oral 1)

### **Session Director**

Giho Moon (Armed Forces Capital Hospital, Korea)

### **Moderator**

Ki Chul Park (Hanyang University, Korea)

Seung Hwan Pyun (Armed Forces Medical Command, Korea)

- 
- Oral 1-1 Introduction of military EMS development
  - Oral 1-2 Penetrating abdominal injury
  - Oral 1-3 Traumatic lower extremity amputation
  - Oral 1-4 Epidemiology of Traumatic Spinal Cord Injury in Korean Military



# Introduction of Military EMS Development

Daehyun Kang

Armed Forces Capital Hospital, Korea

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## Abdominal Gun Shot Wounds

Hojun Lee

국군의무사령부 국군수도병원

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# Traumatic Lower Extremity Amputation

Gi Ho Moon

Armed Forces Capital Hospital, Korea

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## Incidence Estimation and Severity Determinants of Traumatic Spinal Cord Injury in Korean Military

Jeong-Gil Kim

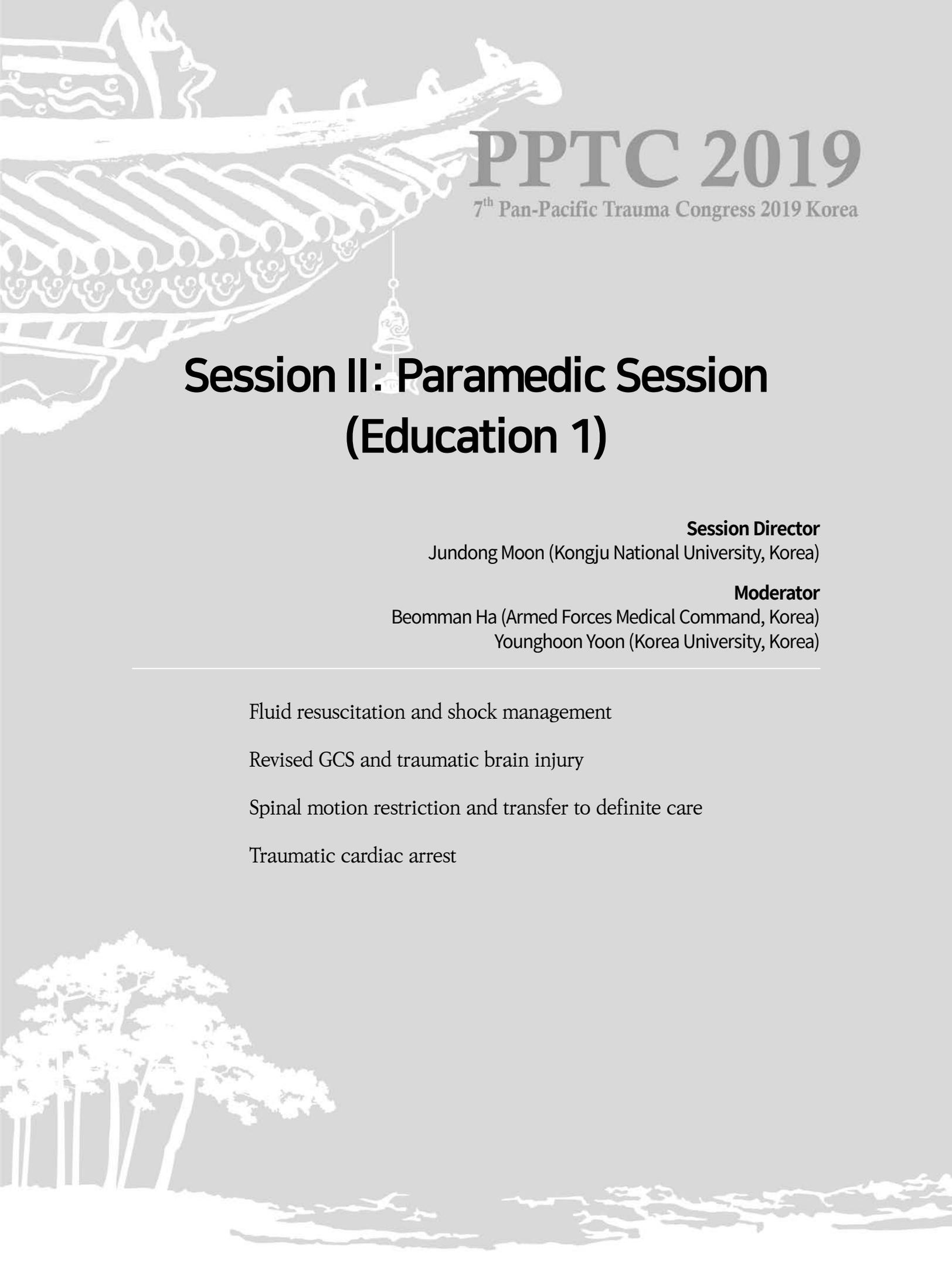
Armed Forces Daejeon Hospital

**Object:** To evaluate the incidence and severity determinants of traumatic spinal cord injuries by reviewing the medical records of all patients with traumatic spinal cord injuries registered in the N-DEMIS(New Defense Medical Information System).

**Methods:** From May 2012 to December 2017, a total of 3,011 patients with a diagnosis of traumatic spinal cord injury registered on N-DEMIS were listed and duplicate patients were eliminated. Then, 89 patients with traumatic spinal cord injuries who finally meet the definition of American Spinal Injury Association (ASIA) were reviewed by a rehabilitation specialist.

**Results:** The average incidence of traumatic spinal cord injury in the study was 24.99 per 1 million people per year. The military officers were 19 (21.3%), NCOs (non-commissioned officers) 30 (33.7%), soldiers 38 (42.7%), and cadets 2 (2.25%). And army (86.5%), navy (7.9%) and air force (5.6%) were identified and the mean age at injury was 29.82 ( $\pm$  9.99) years. According to the common classification criteria of overseas researches, 37 cases (41.6%) suffered traumatic spinal cord injury due to falls, 16 cases (18.0%) were injured by motor vehicles accidents, There were 14 (15.7%) injuries during military training, 11 (12.4%) sports injuries, 7 (7.9%) diving injuries and 4 (4.5%) other injuries. There were 64 patients (71.9%) of cervical spinal cord injuries, 9 patients (10.1%) of thoracic spinal cord injuries, and 16 patients (18.0%) of lumbosacral spinal cord injuries. When the severity of traumatic spinal cord injury was classified as 'complete paralysis' and 'incomplete paralysis', the shorter the military career and the younger age at the time of injury, the more significant correlation was found with the severity of traumatic spinal cord injury.

**Conclusion:** This is the first study to present the incidence of traumatic spinal cord injuries in military by epidemiological method and to analyze the incidence of specific population in Korea.



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7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session II: Paramedic Session (Education 1)

### **Session Director**

Jundong Moon (Kongju National University, Korea)

### **Moderator**

Beomman Ha (Armed Forces Medical Command, Korea)  
Younghoon Yoon (Korea University, Korea)

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Fluid resuscitation and shock management

Revised GCS and traumatic brain injury

Spinal motion restriction and transfer to definite care

Traumatic cardiac arrest



# Fluid Resuscitation and Shock Management

Eunjoo Kwag

Daewon University, Korea

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## Revised GCS and Traumatic Brain Injury

Sieun Park

Donggang University, Korea

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## Spinal Motion Restriction and Transfer to Definite Care

Anjie Yoo

United States Forces, Korea

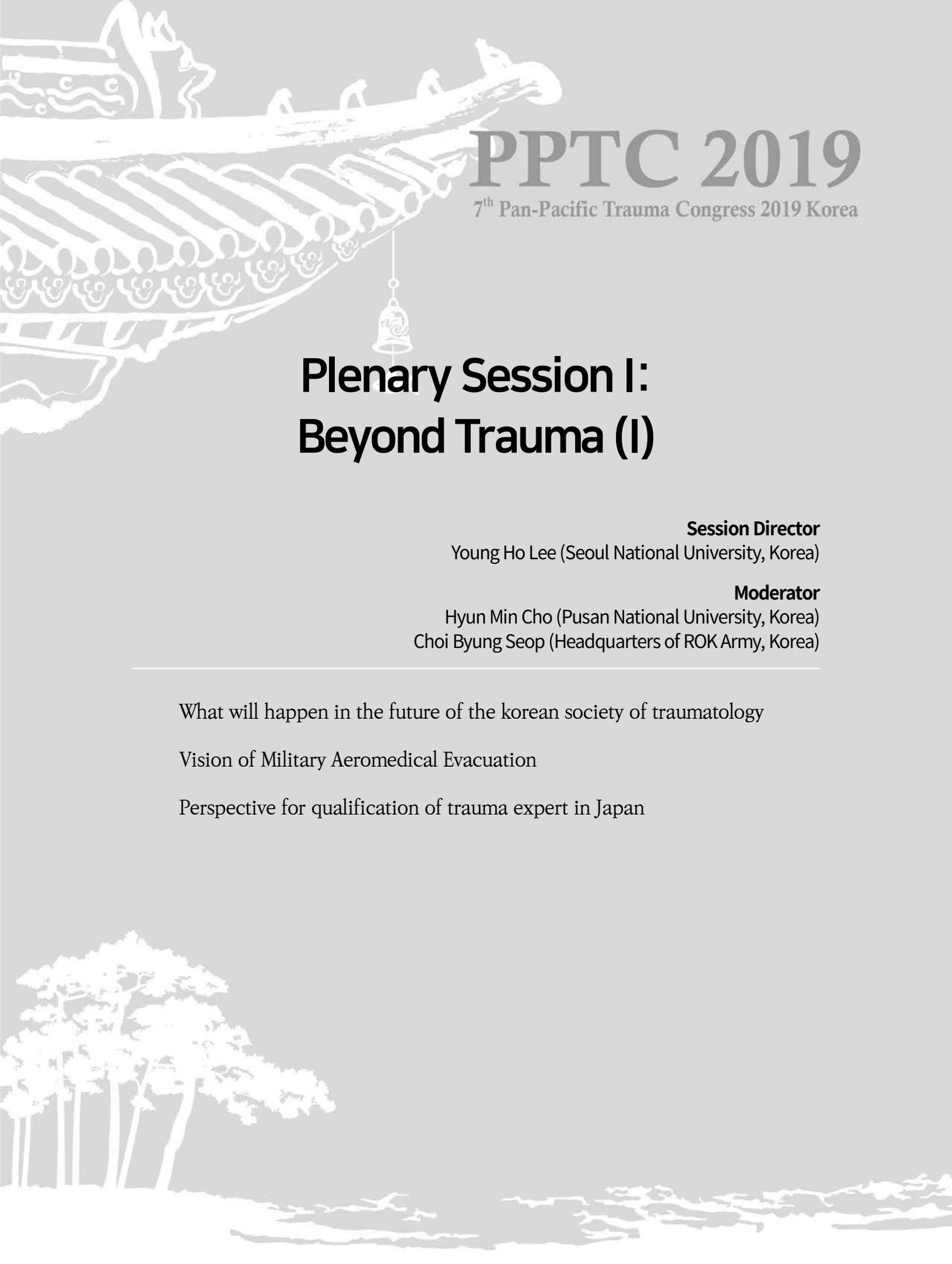
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# Traumatic Cardiac Arrest

Jundong Moon

Kongju National University, Korea

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# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Plenary Session I: Beyond Trauma (I)

### **Session Director**

Young Ho Lee (Seoul National University, Korea)

### **Moderator**

Hyun Min Cho (Pusan National University, Korea)  
Choi Byung Seop (Headquarters of ROK Army, Korea)

---

What will happen in the future of the Korean society of traumatology

Vision of Military Aeromedical Evacuation

Perspective for qualification of trauma expert in Japan



# What Will Happen in the Future of Korean Society of Traumatology

Sung-Hyuk Choi

Department of Emergency Medicine, College of Medicine, Korea University, Seoul, Korea

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Let me introduce about changing the treatment of trauma patients due to the evolution of information technology in the future. The order will be based on trauma patients management system in the future, current trauma management system in Korea, advanced trauma management system, comparison of trauma management system between Korea and the developed country, ICBMA (internet of things, cloud computing, big data, mobile and artificial intelligence) based trauma patients management system, I hope we will prepare now to improve the prognosis of trauma patients in the future.

# Vision of Military Aeromedical Evacuation

Jong Ha Moon

Armed Forces Medical Command, Korea

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## Perspective for Qualification of Trauma Expert in Japan

Akio Kimura

Chair of Executive Board of the Japanese Association for Surgery of Trauma (JAST)

---

A considerable number of trauma cases are due to traffic accidents, industrial accidents, violence, and natural disasters. In Japan, approximately 20 million people are treated at hospitals for trauma yearly, approximately 1.2 million people are admitted to hospitals, and more than 20 thousand people die. Moreover, trauma patients account for 28% (1.42 million people) of the sick and injured who transported to hospitals by ambulance.

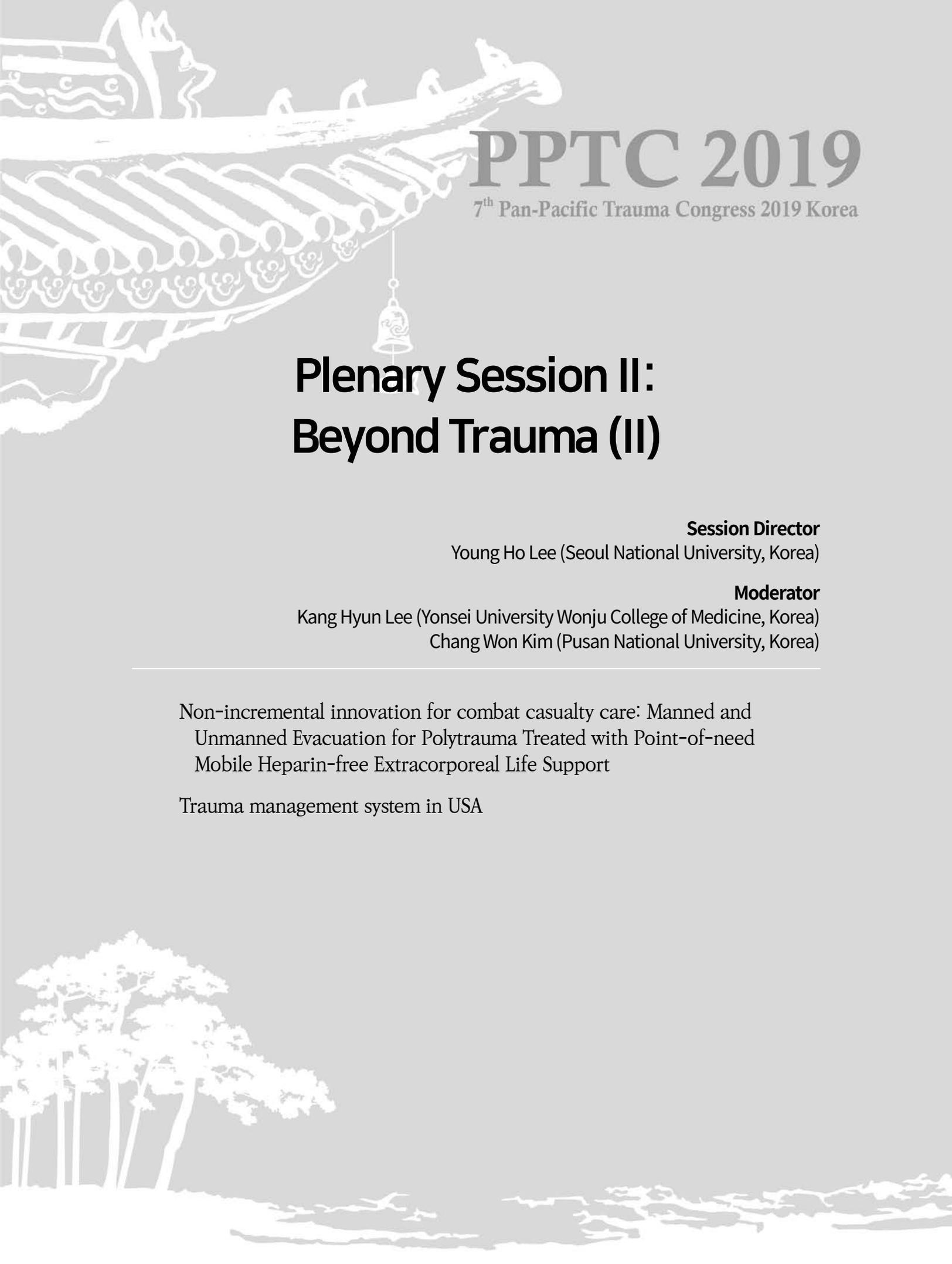
Multiple regions of the body are injured in many cases of severe trauma, and treatment may be difficult when these cases are handled by one surgical department alone. Although physicians of several departments cooperate to initiate treatment, if the order and composition of the management are inappropriate, a favorable outcome is not possible. Thus, the presence of a team leader knowledgeable in trauma management who can judge the order of priority for examinations and interdisciplinary treatments within a limited time for urgent and severe cases is essential. In addition, although trauma is limited to a single region, systemic care is necessary in severe cases. 'Trauma experts' were established based on this necessity, and they represent physicians certified in this subspecialty who acquired advanced knowledge and skills.

The definition of a trauma expert by JAST is 'a physician who is able to systematically perform proper initial management and acute phase management including intensive care, and evaluates their performance in order to promote of medical progression regarding severe trauma, to improve the level of total care of trauma, and to ultimately contribute to national welfare'.

The ability to perform immediate trauma care is required for emergency physicians, but difficult resuscitation techniques or complete perioperative intensive care is not required. Thus, although the initial treatment overlaps, the ability to treat trauma that is required for emergency physicians is only a part of the requirements for trauma experts. Physicians of each basic surgical specialty are also required to be able to treat traumas within their specialty, but interdisciplinary knowledge and the ability to judge across basic specialties are not required. Therefore, having a 'trauma expert', which is an interdisciplinary subspecialty, to ensure quality of trauma management from resuscitation to rehabilitation can greatly improve the national medical welfare.

At present, 225 trauma experts have been certified by the Japanese Association for Surgery of Trauma. To ensure at least one trauma expert for 24 hours for 365 days, more than 5 specialists are necessary per tertiary emergency care facility. Accordingly, to fulfill all 78 facilities currently certified as expert training centers, 390 specialists are necessary. The current number of trauma experts is markedly insufficient.





# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Plenary Session II: Beyond Trauma (II)

### **Session Director**

Young Ho Lee (Seoul National University, Korea)

### **Moderator**

Kang Hyun Lee (Yonsei University Wonju College of Medicine, Korea)

Chang Won Kim (Pusan National University, Korea)

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Non-incremental innovation for combat casualty care: Manned and  
Unmanned Evacuation for Polytrauma Treated with Point-of-need  
Mobile Heparin-free Extracorporeal Life Support

Trauma management system in USA



# Non-incremental Innovation for Combat Casualty Care: Manned and Unmanned Evacuation for Polytrauma Treated with Point-of-need Mobile Heparin-free Extracorporeal Life Support

Andriy Batchinsky

The Geneva Foundation, Tacoma, WA; U.S. Army Institute of Surgical Research, JBSA Ft Sam Houston, TX

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## Introduction

In contrast to previous military conflicts when medical evacuation of casualties was carried out in an environment of air superiority, future conflicts and medical care for casualties are likely to occur in an Anti-Access/Area Denial (A2/AD) asymmetric multidomain battlefield conditions. These conditions will lead to accumulation of severely injured casualties requiring sustained life preservation at point of injury/need and novel unmanned evacuation (UE) solutions. To address these challenges unmanned aerial systems and vehicles (UAV) are developed as force multipliers capable of ensuring logistical support, delivery of medical capabilities and UE of severely injured casualties in A2/AD conditions.

To ensure life sustainment goals in the most severely injured we propose a potent therapeutic capability enabling comprehensive interventions in the most injured- Extracorporeal Life Support (ECLS). ECLS enables support of respiration and cardiovascular function, rapid temperature control, can be used as a single point pump-driven resuscitation and medication delivery hub. At present ECLS is used as a last resort intervention in the most critically ill trauma patients that have failed all other forms of therapy in civilian trauma centers. A primary reason for the last resort utilization of ECLS is the need to administer systemic heparin to prevent contact activation of the coagulation system during ECLS. In this study we revolutionize utilization of life-saving ECLS capabilities as a first line defense in life threatening trauma. We investigated cardiovascular and pulmonary physiology during manned and unmanned evacuation of large animals subjected to combat -relevant polytrauma managed with mobile heparin-free ECLS. We hypothesized that heparin-free ECLS enables sustained preservation of life during aeromedical evacuation at ground, 5k, 8k and a rapid decompression sequence at 30k feet, while enabling lung protective mechanical ventilator settings and preventing multiorgan failure.

## Methods

After IACUC and AF Surgeon General Approvals, female swine (n= 18, weight 54.1±1.2kg) were anesthetized,

tracheostomized, instrumented with arterial and venous monitoring lines and placed on mechanical ventilation (MV, settings: 10ml/kg tidal volume, 12-14 respiratory rate (RR) titrated to normocarbia) and a 23 F veno-venous bi-caval jugular catheter connected to the Cardiohelp ECLS system (Getinge, Rastatt, Germany). ECLS blood flow was set at a partial-to-mid-range of 1.2-1.8 L/min and 2-6 L/min sweep gas flow consisting of 100% O<sub>2</sub>. The study involved 2 phases over 48 hours. In phase 1 (healthy physiology of manned evacuation and UE), animals underwent baseline (BL), post ECLS, pre-transport data collection followed by ground evacuation to high-altitude chambers in an adjacent building utilizing the medical equipment rail kit (MERK) mounted on a standard NATO litter. The MERK was configured as an autonomous critical care system and housed intensive care unit (ICU) equipment to include: Dräger M540 critical care monitor (Dräger, Lubeck, Germany); the SAVe II ventilator (Automedex, Coppel, Tx); three Medsystem III I/V pumps (Carefusion, Yorba Linda, CA); direct pressure transducing trifurcated set (ICU Medical, San Clemente, CA); Impact 326M suction apparatus, (Zoll Medical, Chelmsford, MA); power supply; oxygen tank; I/V fluid bags and pressure bags. After ground transport with continuous digital vital sign and waveform data collection to the flight chamber, a 4-hour manned flight was carried out in healthy state at 5 and 8k feet followed by rapid ascent to 30k feet (rapid decompression scenario) in an unmanned fashion (UE), then return to 5 K feet and sea level. After completion of the flight, animals were transported back to the ICU and received one-on-one ICU care overnight with the ECLS support discontinued (sweep gas turned down to "0"). Heparin was administered on Day 1 only in healthy state at a rate of 20 U/kg/hr. At midnight of day 1, the healthy experimental phase 1 was completed and the experiment continued with Phase 2 which involved injury and post injury stabilization and transport with identical phases of those of Phase 1. Phase 2 began with discontinuation of heparin followed by a severe bilateral chest trauma 8 hours later. Trauma was carried out using the captive bolt apparatus (Carl Schermer, Ettlingen, Germany) discharged at the intersection of the right axillary and xiphoid lines. After this, right sided pulmonary contusion (PC) a Dry Seal chest drain (Atrium Express, Getinge, Germany) was connected to a chest tube placed via a thoracostomy. The same procedure was repeated on the left side resulting in bilateral PC. ECLS sweep gas flow was resumed as described in Phase 1 and animals were managed by adjunct use of MV and ECLS while minimizing TV and RR and carrying out most of the gas exchange via the ECLS system. All data collection timepoints and transport from Day 1 were repeated in the same manner but with an injured animal with continued ICU support, 2 chest tubes and Dry Seal systems, and standard of care (fluid administration and pressors continued at all times of Day 2). Vital signs, ventilator data, arterial and venous blood gas data, ECLS performance data, an extended panel of coagulation variables were collected and analyzed. Statistics by SAS v.9.4, Cary, NC Data shown as means ± SEM, p<.05 with Kruskal-Wallis Adjustment.

## Results

All animals survived transport and manned and UE phases. Two animals died after injury on day 2 and were excluded from the study. Mean Arterial Pressure decreased (91.4±2.40 to 76.33±3.12 (p<0.05) mmHg after ECLS initiation on day 1 and a decrease from 86.53±3.54 to 57±2.54 after injury on day 2 (p<.05). ECLS blood flow was 1-1.2 L/min on day 1 and 1.2-1.8 L/min on day 2 with a brief peak at 2.2 L/min after injury. No changes were made during AE. Activated clotting time (ACT) ranged from 85 sec at baseline to 180 sec during Day 1 and was at baseline levels or lower on Day 2 (p<.05). Oxygen saturation remained normal at all times but decreased during rapid decompression at 30K (76.4±7.81%, NS) on Day 1 and day 2 (83.75±5.67%, NS). Arterial PaO<sub>2</sub> remained

normal at all stages of the study but for both rapid decompression phases when it decreased to  $56.6 \pm 13.81$  mmHg on day 1 ( $p < 0.05$ ) and again to  $55 \pm 9.12$  mmHg on day 2 ( $p < 0.05$ ). PFR decreased after ECLS initiation on day 1 but remained normal except the UE phase when it decreased to  $263 \pm 66$  - mild ARDS. Injury led to an early mild decrease in PFR which subsequently developed into moderate- and then severe ARDS (PFR= $60.71 \pm 8.33$ ,  $p < 0.05$ ) during UE on Day 2 with eventual recovery to normal levels upon completion of aeromedical evacuation and return to the ICU. Minute ventilation decreased from  $8.16 \pm 0.26$  l/min at BL to  $4.3 \pm 0.44$  l/min- a decrease by 50% ( $p < 0.05$ ) after ECLS initiation and remained lower during all stages of flight on Day 1. On Day 2 after injury, ECLS utilization led to a 64% average reduction in minute ventilation ( $p < 0.05$ ). Furthermore, the TV/kg was maintained in the 8-8.5 ml/kg range on Day 1 and at 6-6.5 ml/kg (lung protective settings) on Day 2. Thromboelastography showed reduction in clot strength after initiation of ECLS which was sustained post-ECLS ( $p < 0.05$ ). Clot formation time and amplification rate were prolonged on day 2 (K= $1.5 \pm 0.1$  to  $4.0 \pm 0.7$ min,  $p < 0.05$ ;  $\alpha$  angle= $69 \pm 1^\circ$  to  $49 \pm 1^\circ$ ,  $p < 0.05$ ). Of special note, all animals survived the 30k rapid decompression UE stages without complications.

## Conclusion

We developed a mobile, point of need ICU capability and tested heparin free ECLS as a first line intervention after combat-relevant trauma and a platform intervention for use in UAVs during A2/AD multidomain conditions. ECLS enables sustained damage control preservation and maintenance of cardiovascular and respiratory function while minimizing mechanical ventilator settings in austere environment and permits stable ground and manned and unmanned high-altitude evacuation to include rapid decompression scenarios. Further miniaturization, ruggedization and simplification of these systems will enable their initiation at point of injury/need and permit sustained comprehensive life support for the most severely injured whom currently are classified to have sustained non-survivable injuries.

## Trauma Management System in the USA: Focus on Interventional Radiology

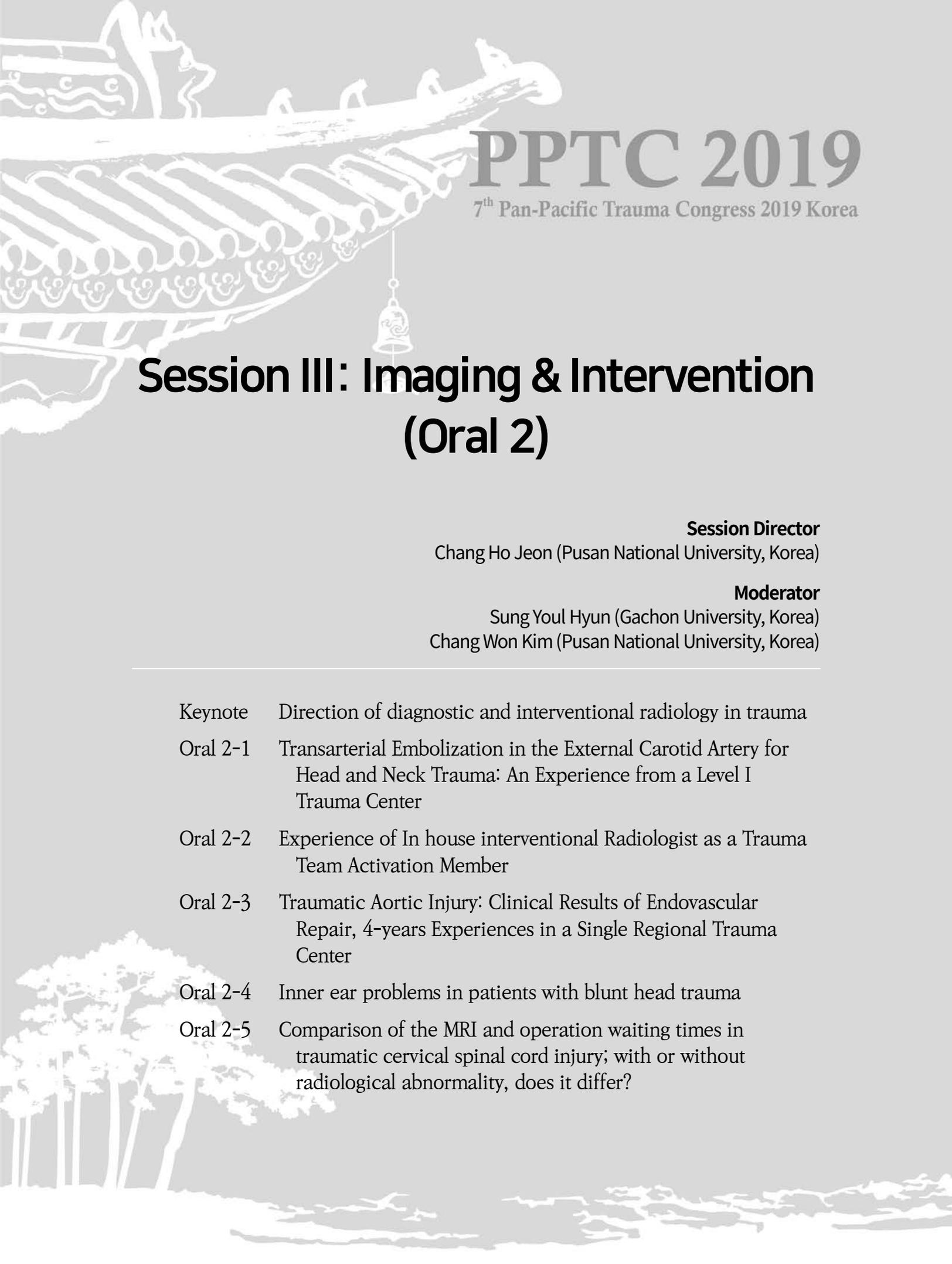
Andre Uflacker

Vascular and Interventional Radiology, University of Virginia Health System, Charlottesville, VA

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**Objectives:** To introduce the trauma management system found in the United States and the role of Interventional Radiologists in the trauma setting.

**Body:** The contemporary trauma system in the United States has its origins in the military, which can be traced back to the Revolutionary War, and the American Civil War. During the 20th Century, several advances in military trauma management, starting with the use of motorized ambulances in World War I, the use of Penicillin in World War II, to the creation of Mobile Army Surgical Hospital units in the Korean war, and the use of helicopter evacuations have resulted in a streamlined military trauma care system that can evacuate casualties to high levels of care within 1 hour. The American civilian trauma management system borrows significant aspects of its design from the military system, including the concept of the “Golden Hour.” The United States is unusual in that states are responsible for their own healthcare systems. The implementation of state-wide trauma systems is under the jurisdiction of each of the fifty US states. Trauma systems began to be created in the 1960’s, and have evolved over the decades to the present day system, which albeit incomplete, has markedly improved outcomes than five decades ago. An American Level 1 Trauma Center is usually a large institution that contains an extensive infrastructure including focus on optimal management of the injured patient, research trauma outcomes and quality improvement, and training and education of providers. A badly injured 18yo male in a motor vehicle collision that involved the use of a trauma alert, hybrid operating room, and embolotherapy is provided as a case study.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session III: Imaging & Intervention (Oral 2)

### Session Director

Chang Ho Jeon (Pusan National University, Korea)

### Moderator

Sung Youl Hyun (Gachon University, Korea)

Chang Won Kim (Pusan National University, Korea)

- 
- |          |   |
|----------|---|
| Keynote  | Direction of diagnostic and interventional radiology in trauma  |
| Oral 2-1 | Transarterial Embolization in the External Carotid Artery for Head and Neck Trauma: An Experience from a Level I Trauma Center                        |
| Oral 2-2 | Experience of In house interventional Radiologist as a Trauma Team Activation Member  |
| Oral 2-3 | Traumatic Aortic Injury: Clinical Results of Endovascular Repair, 4-years Experiences in a Single Regional Trauma Center                              |
| Oral 2-4 | Inner ear problems in patients with blunt head trauma   |
| Oral 2-5 | Comparison of the MRI and operation waiting times in traumatic cervical spinal cord injury; with or without radiological abnormality, does it differ? |



# Direction of Diagnostic and Interventional Radiology in Trauma

Chang Won Kim

Pusan National University, Korea

---

## Transarterial Embolization in the External Carotid Artery for Head and Neck Trauma: An Experience from a Level I Trauma Center

Lee Hwangbo<sup>1</sup>, Jae Il Lee<sup>2</sup>, Soo Hee Kim<sup>2</sup>, Tae Hee Shin<sup>2,3</sup>, Tae Hong Lee<sup>1</sup>

<sup>1</sup>Pusan National University Hospital, <sup>2</sup>Pusan National University Hospital, <sup>3</sup>Busan Medical Center

---

**Objective:** To report a single-center experience of angiographic and clinical outcomes in patients who underwent transarterial embolization in the external carotid artery for head and neck trauma.

**Methods:** In this retrospective study, we identified eleven patients (women, 3; men 9; median age 67 years) who underwent transarterial embolization in the external carotid artery for head and neck trauma between Jan 2011 and Dec 2018. The technical success was defined as immediate angiographic obliteration of the culprit lesion, while the clinical success as stabilization or resolution of head and neck symptoms not previously responding to nonoperative or operative treatments. Major complications were defined according to the Society of Interventional Radiology Clinical Practice Guidelines.

**Results:** Technical success was achieved in all eleven patients, with clinical stabilization or complete resolution of presenting symptoms. There were no documented major complications.

**Conclusion:** In conclusion, transarterial embolization in the external carotid artery seems to offer safe and effective control of arterial injuries of the head and neck in trauma patients.

## Experience of In House Interventional Radiologist as a Trauma Team Activation Member

Sungnam Moon

Wonkwang University Hospital

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Trauma is the leading cause of death in people younger than 45 years of age, and the main cause of death in children.

The trauma team generally includes trauma surgeons, other surgeons, anaesthetists, ancillary personnel, etc. About a year ago, our Trauma center included an interventionalist in the trauma team.

And it has caused many changes in the treatment of trauma patients.

The main interventional radiology methods for trauma care are: embolization with temporary or permanent particles and agents such as coils, plugs, and even glues; stenting with different kinds of stents and/or stent-grafts and placement of balloon occlusion catheters in injuries to large vessels such as the aorta or inferior vena cava.

## Traumatic Aortic Injury: Clinical Results of Endovascular Repair, 4-years Experiences in a Single Regional Trauma Center

Chang Ho Jeon<sup>1</sup>, Chang Won Kim<sup>1</sup>, Hoon Kwon<sup>1</sup>, Hyun Min Cho<sup>1</sup>, Jae Hun<sup>1</sup>,  
Seon Hee Kim<sup>1</sup>, Sun Woo Choi<sup>1</sup>, Chan Kyu Lee<sup>1</sup>, June Pill Seok<sup>1</sup>, Chan Yong Park<sup>2</sup>

<sup>1</sup>Pusan National University Hospital, <sup>2</sup>Wonkwang University Hospital

**Objectives:** Traumatic aortic injury (TAI) is rare but is highly fatal. In determining how to treat TAI, there are many factors to consider, due to the complexity of concomitant traumatic injuries. European Society of Cardiology recommends that thoracic endovascular aortic repair (TEVAR) should be preferred to open surgical repair in cases of TAI with suitable anatomy. We evaluated the clinical efficacy and safety of TEVAR for treatment of TAI.

**Methods:** A retrospective electronic medical record review of all patients undergoing TEVAR for TAI between November 2014 and September 2018 at a Korean regional trauma care center was performed. Reviewed results included patient demographics, initial and follow-up CT scan results, angiographic findings, TAI type and sites, time from injury to repair, injury severity score, and clinical outcomes including survival duration and procedure-related complications.

**Results:** Seventeen trauma patients from single trauma care center underwent TEVAR. Mean age was 54 years and 15 patients were male. The proximal landing zone involved aortic arch zone 2 in 35.3% and zones 3 and 4 in 64.7% of procedures. Technical success was achieved in all cases. No patient developed procedure-related paraplegia or required conversion to open surgery. Follow-up imaging demonstrated complete exclusion of the traumatic tear and regression of the false aneurysms without endoleak or stent graft induced new entry or symptom of steal syndrome during follow-up duration 332.0 ± 85.0 (15-903 days). Thirty-day mortality was 5.9 % (n=1).

**Conclusion:** TEVAR is a reliable, safe, convenient and with less complications for TAI, especially given the consideration in cases with suitable aortic anatomy and appropriate hemodynamic status.

## Inner Ear Problems in Patients with Blunt Head Trauma

Ji Eun Choi, Ye Rim Chang, Min Young Lee, Jung-ho Yun, Jae Yun Jung

Dankook University Hospital

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**Objective:** The aim of study was to determine the incidence and characteristics of inner ear problems in patients with blunt head trauma, and to evaluate factors related to inner ear problems.

**Methods:** This prospective study was conducted on 114 patients with blunt head trauma from May 2018 to December 2018. After finishing critical care, 101 patients were referred to ENT clinic. Assessment included cause of trauma (traffic accident, falls, slip down, and assault), severity of trauma (duration of critical care, GCS, and ISS), radiologic evaluation (hemorrhage of temporal lobe and fracture of temporal bone), types of hearing loss, and characteristics of nystagmus.

**Results:** A total of 68 patients completed routine ENT consultation. Three patients refused consultation with ENT and 30 patients lost to follow-up. During ENT consultation, 45 patients (66%) were identified with trauma related hearing loss or dizziness. Of the 23 patients with hearing loss, 12 had sensorineural hearing loss, 10 had conductive hearing loss, and one had mixed hearing loss. Of the 31 patients with dizziness, 5 had no nystagmus, 13 had direction-changing positional nystagmus, 13 had direction-fixed positional nystagmus. A total of 33 patients (49%) were classified as patients with inner ear problems, except for patient with conductive hearing loss and subjective dizziness. However, there were no significant differences of age, sex, cause and severity of trauma, and radiologic evaluation between trauma patient with and without inner ear problem.

**Conclusion:** About half of patients with blunt head trauma showed trauma related inner ear problems. However, trauma related inner ear problems had no significant association with age, gender, cause of trauma, severity of trauma, and radiologic findings. Therefore, it is important to obtain a patient history specific to hearing loss or dizziness and to provide appropriate referrals.

## Comparison of the MRI and Operation Waiting Times in Traumatic Cervical Spinal Cord Injury; with or without Radiological Abnormality, Does It Differ?

Jeong Heo, Woo-Kie Min, Chang-Wug Oh, Joon-Woo Kim

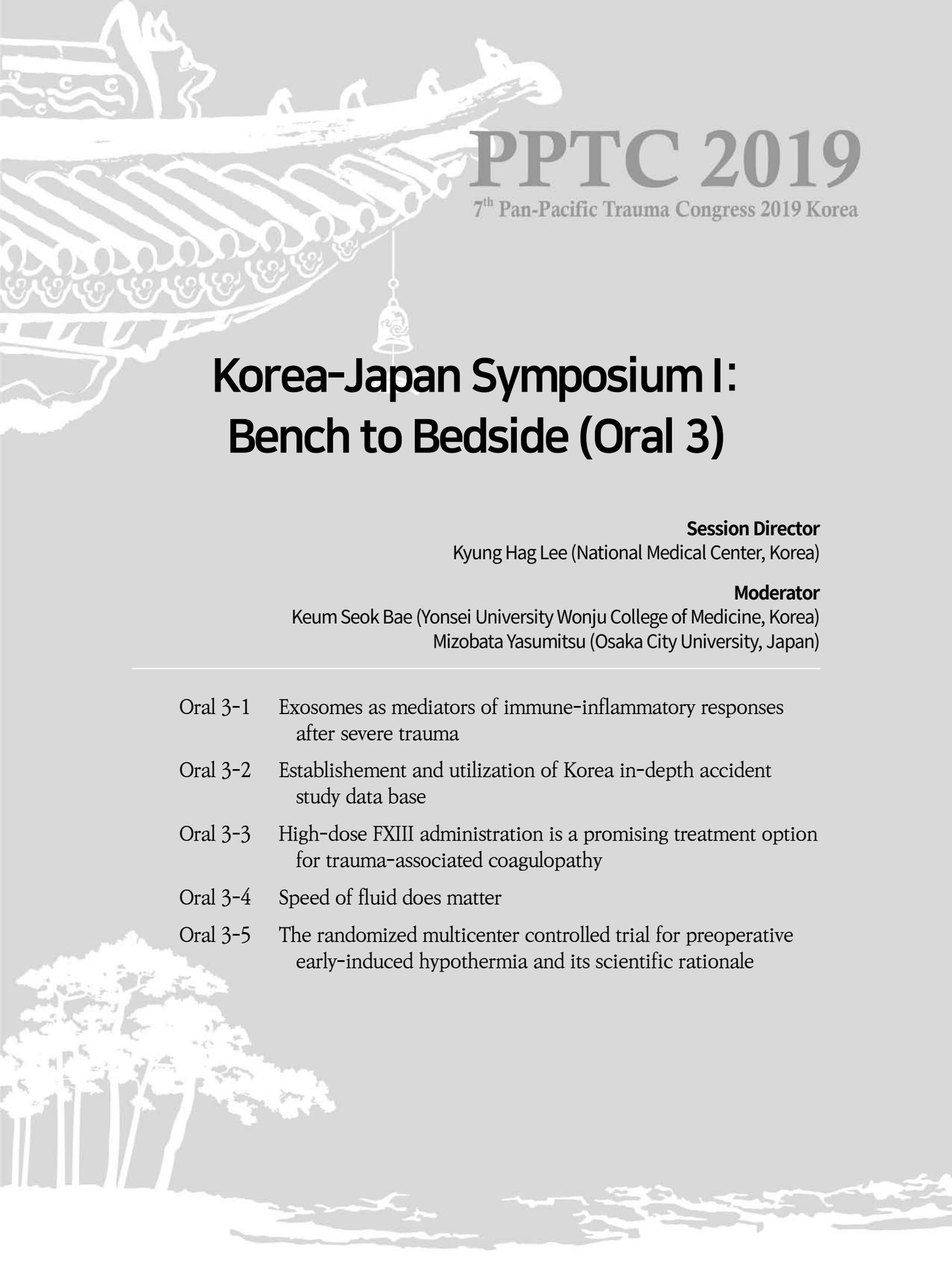
Kyungpook National University Hospital

**Objective:** Cervical spinal cord injury (SCI) result high mortality and complications. Bony lesion such as fracture-dislocation may be accompanied or not. Surgical treatment is recommended, but it is common to take MRI before surgical treatment, and usually takes time to evaluate. Therefore, the purpose of this study is to compare the time required for MRI and surgery in cases with and without fracture-dislocation

**Methods:** Retrospectively analyzed the patients visited our institution from 2012 to 2018. Adult patients who underwent surgical treatment with SCI within 24hours were included. The patients suspected to have cervical spinal injury were taken CT at the time of arrival. MRI was performed after initial examination, and surgical treatment was performed. Waiting times for MRI and surgery were evaluated.

**Results:** A total of 34 patients were included. The mean age was 57.5years, and male-to-female ratio was 31:3. Patients with definite bony lesion were classified as group(A), and 10 cases were identified. Patients without bony lesions were classified as group(B), and 24 cases were identified. The mean interval between arrival of the emergency room and the start of MRI was 93.60( $\pm$ 60.08) minutes in group(A), 313.75( $\pm$ 264.89) minutes in group(B), and significantly shorter in group(A)( $p=0.01$ ). The mean time to surgery was 248.4( $\pm$ 76.03) minutes in the group(A) and 560.5( $\pm$ 372.56) minutes in the group(B), and the difference was statistically significant( $p=0.001$ ). The ASIA scale at the time of arrival showed that the group(A) had a relatively severe neurologic deficit( $p=0.046$ ).

**Conclusion:** Cervical SCI with bony lesion group take significantly shorter time to take MRI and surgery than group without definite bony lesion. If fracture-dislocation is found in CT scan, SCI could be easily predicted. Therefore, it is presumed that MRI and surgical treatment were performed more rapidly. In addition, fracture-dislocation tends to cause more severe neurological damage, so it is presumed that rapid diagnosis and treatment were possible.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Korea-Japan Symposium I: Bench to Bedside (Oral 3)

### **Session Director**

Kyung Hag Lee (National Medical Center, Korea)

### **Moderator**

Keum Seok Bae (Yonsei University Wonju College of Medicine, Korea)  
Mizobata Yasumitsu (Osaka City University, Japan)

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- Oral 3-1 Exosomes as mediators of immune-inflammatory responses after severe trauma
  - Oral 3-2 Establishment and utilization of Korea in-depth accident study data base
  - Oral 3-3 High-dose FXIII administration is a promising treatment option for trauma-associated coagulopathy
  - Oral 3-4 Speed of fluid does matter
  - Oral 3-5 The randomized multicenter controlled trial for preoperative early-induced hypothermia and its scientific rationale



## Exosomes as Mediators of Immune-inflammatory Responses after Severe Trauma

Mitsuaki Kojima, Koji Morishita, Junichi Aiboshi, Yasuhiro Otomo

Trauma and Acute Critical Care Center, Medical Hospital, Tokyo Medical and Dental University

Multiple organ failure (MOF) is the leading cause of delayed mortality after trauma/hemorrhagic shock (T/HS). In patients with T/HS, tissue injury and splanchnic ischemia/reperfusion trigger a cascade of pro-inflammatory reactions called the systemic inflammatory response syndrome (SIRS). Although this response is required as part of the initial host response to injury and resolves in most patients as they recover, uncontrolled SIRS can lead to distant organ injury and MOF. The pathophysiology of MOF after injury is poorly understood; hence, extensive efforts have focused on clarifying the basic biology of T/HS-induced organ injuries. Dr. E.E. Moore's group demonstrated the pivotal role of post-shock mesenteric lymph (ML) that provides gut-derived factors as a source of pro-inflammatory mediators after T/HS. Previous studies have also demonstrated that ML diversion or mesenteric duct ligation abrogates postinjury acute lung injury. Further, injection of post-shock ML into naive animals recreates acute lung injury (ALI) observed after T/HS, supporting the critical role of biologically active ML in generating the SIRS response. Although the importance of the gut and specifically the ML, in generating the SIRS response has been well recognized for almost two decades, the identity of the biologically active components within the ML that lead to the SIRS response is still not completely understood.

We have recently identified the presence of small particles, "Exosomes," in rat ML and demonstrated that exosomes in post-shock ML could trigger a variety of pro-inflammatory responses. Exosomes are nano-sized (40-100 nm) extracellular vesicles secreted from most types of immune cells into various body fluids such as serum, urine, saliva, and cerebral spinal fluid, and are known to carry a variety of biologically active contents, including lipids, protein, mRNAs, and microRNAs. Growing evidence has demonstrated that exosomes are a critical mediator of cell-to-cell communication, which is involved in the progression of pathophysiological conditions such as tumorigenesis. Even though many studies have focused on exosomes' role in cancer, their role in injury or hemorrhagic shock remains unknown. Our current focus is on the characterization of exosomes secreted during T/HS and resuscitation based on a systematic analysis of their abundance, size, surface epitope profile, and payload. The studies proposed will dissect a novel mechanism to the discovery of new therapeutic targets of postinjury MOF.

# Establishment and Utilization of Korea in-depth Accident Study Data Base

Oh Hyun Kim

Yonsei University Wonju College of Medicine, Korea

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## High-dose FXIII Administration Is a Promising Treatment Option for Trauma-associated Coagulopathy

Futoshi Nagashima

Saga University, Japan

**Background:** Uncontrolled bleeding and coagulopathy due to trauma are responsible for approximately half of trauma deaths within the first 2 days after the injury. Trauma coagulopathy (TC) is an early and primary complication in severe trauma patients. Factor XIII is a transglutaminase that has a variety of physiologic functions to stabilize the clot strength. The goal of this study was to investigate whether the administration of FXIII improves the condition of TC both in vitro and in vivo.

**Methods:** We evaluated the effects of different doses, including a very high dose of FXIII (3.6–32.4 IU/mL) on t-PA-induced hyperfibrinolysis and the combined condition of dilutional coagulopathy and t-PA induced hyperfibrinolysis in vitro. The coagulation status was analyzed by rotational thromboelastometry (ROTEM) and Sonoclot. Then, we evaluated the effect of high-dose FXIII (300 IU/kg) for severe coagulopathy in vivo using a rat liver trauma model in which coagulopathy similar to TC was observed. Survival time and the amount of intra-abdominal bleeding of rats were measured, and a coagulation test was also performed with ROTEM and Sonoclot. Histologic examination of rats' lung and kidney after FXIII administration were evaluated.

**Results:** High-dose FXIII significantly improved clot strength as well as increased resistance to hyperfibrinolysis in vitro which was confirmed by ROTEM. Platelet function on Sonoclot was significantly increased by FXIII in a dose-dependent manner. Factor XIII significantly decreased the total amount of bleeding and prolonged the survival time compared to control (control vs FXIII:  $108.9 \pm 11.4$  vs  $32.6 \pm 5.5$  mL/kg;  $p < 0.001$ ;  $26.0 \pm 8.8$  vs 120 minutes,  $p < 0.001$ ) in a rat in vivo model. ROTEM parameters and platelet function on Sonoclot were significantly improved in the FXIII administration group compared to control. No adverse effects of FXIII were detected histologically.

**Conclusion:** Factor XIII not only generated stable clot resistance to hyperfibrinolysis but also enhanced platelet function by facilitating clot retraction. High-dose FXIII administration therapy has significant clinical impact for severe trauma accompanied with TC, contributing to primary hemostasis by platelet function and secondary hemostasis by fibrin clot.

## Speed of Fluid Does Matter!

Kyuseok Kim

Seoul National University

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**Objective:** To investigate the speed of fluid influence the resuscitation outcome in ischemia/reperfusion injury

**Methods:** In in-vitro study, hypoxia and reoxygenation model with RAW cell were used. SD rat and pig were used to investigate the effect of slow resuscitation in hemorrhagic shock model.

**Results:** In in-vitro study, slow reoxygenation improved cell viability and decreased inflammatory and apoptotic marker. In rat animal model, slow fluid resuscitation increased survival rate and decreased the liver injury. Mechanistic study showed same results with in vitro study. In pig study, the slow resuscitation showed better hemodynamic results compared to control group.

**Conclusion:** In ischemia/reperfusion injury, slow resuscitation could increase survival rate and mitigate organ injury.

# HOPES Trial: The Randomized Multicenter Controlled Trial for Preoperative Early-induced Hypothermia and Its Scientific Rationale

Shoji Yokobori

Department of Emergency and Critical Care Medicine, Nippon Medical School, Tokyo, Japan

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**Objective:** For traumatic brain injury (TBI), therapeutic hypothermia (TH) has not shown efficacy in multicenter randomized controlled trials (RCTs). From the latest RCT (NABISH II and BHYPO), we hypothesized that preoperatively early-induced TH might be beneficial specifically in acute subdural hematoma (ASDH) patients who need evacuation. The aim of this project was thus 1) to test the efficacy of TH in an experimental rat model and 2) to translate these results to a multicenter RCT.

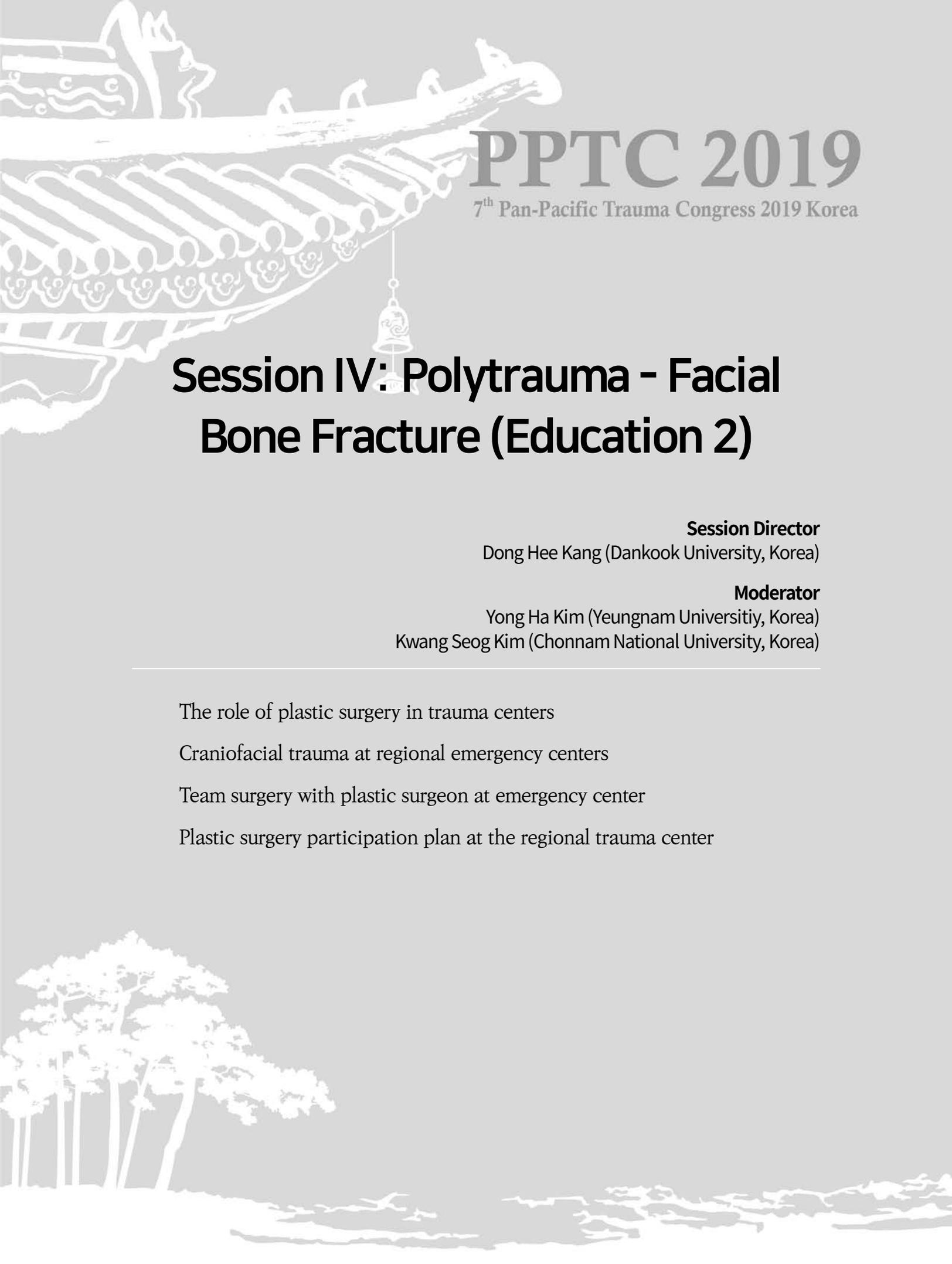
**Methods and Results** - experimental study: Under anesthesia ASDH was induced on rat model, and the rats were placed into: 1) normothermia (37°C) and 2) early-induced TH (33°C, 30 minutes prior to decompressive craniotomy and ASDH removal).

**Results:** The number of degenerating cells, extracellular biomarkers (UCH-L1 and GFAP), and injury volume were significantly smaller in the early hypothermia group than for normothermia (Yokobori et al, J Neurosurg 2013).

**Conclusion** and future implication for multicenter RCT: Our experimental results suggested that preoperatively early-induced TH could mediate the reduction of neural damage in ASDH. We are now going ahead with a multicenter RCT both in JAPAN and US. This trial employs several novel features as below: 1) The trial enrolls only ASDH patients who need emergency surgery 2) The trial determines whether preoperatively induced hypothermia decreases biomarkers and improves outcome, using a new intravascular cooling device, Quattro<sup>®</sup>, for extra-rapid cooling.

**Keywords:** Traumatic Brain Injury, Therapeutic Hypothermia, Acute Subdural Hematoma





# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session IV: Polytrauma - Facial Bone Fracture (Education 2)

### **Session Director**

Dong Hee Kang (Dankook University, Korea)

### **Moderator**

Yong Ha Kim (Yeungnam University, Korea)

Kwang Seog Kim (Chonnam National University, Korea)

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The role of plastic surgery in trauma centers

Craniofacial trauma at regional emergency centers

Team surgery with plastic surgeon at emergency center

Plastic surgery participation plan at the regional trauma center



## The Role of Plastic Surgery in Trauma Centers

Hijin You

Korea University, Korea

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Plastic surgery has historically been linked to war. Despite the undeniable historical involvement of plastic surgery in reconstruction of post-traumatic defects, the role of plastic surgery in trauma centers has been largely undefined. The spectrum of plastic surgery trauma management ranges from primary closure to reconstruction, or replacement of complex physical defects of form and function involving the skin, musculoskeletal system, cranio-maxillofacial structures, extremities, breast, trunk and external genitalia. Patients with polytrauma are usually associated with minor to major limb-threatening injuries which require plastic surgeon's expertise. In addition to limb-saving, the interventions of plastic surgeons reduce the morbidity and sometimes the mortality of the post-traumatic sequelae. Plastic surgery may have a major effect on post-trauma quality of life by returning as many patients as possible to pre-injury function. Trauma training to plastic surgery residents involves exposure and insight into reconstruction from head to toe, comprising all ages and almost all organ systems. The tremendous flexibility of the specialty afforded by plastic surgery training allows for overlap and interaction with a number of other surgical specialties. Vast improvements in trauma patient outcomes have already been made following introduction of the trauma centers. Along with other core specialties involved in the management of trauma, understanding the role of plastic surgery in major trauma is important to improve service design and trauma patient outcomes.

## Craniofacial Trauma at Regional Emergency Centers

Young Joon Jun

Department of Plastic Surgery, Seoul St Mary Hospital, The Catholic University of Korea

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The fields of plastic and reconstructive surgery have a wide range of areas not only for aesthetic surgery but also for congenital deformities, trauma and systemic reconstruction. Areas of these reconstructions include acute extra-visceral injuries, burns, congenital anomalies, post-traumatic deformities, tumors, and hand surgery.

Although the role of plastic surgeons in the emergency center is involved in various minor and major trauma, it is not recognized as important in the field of emergency and trauma due to lack of understanding of plastic surgery field even though it plays a large role in the emergency center.

It is time to discuss which patients are treated by the plastic surgeon at the regional emergency center. I hope this opportunity will give you a better opportunity to understand the plastic surgery field in the trauma society.

In addition, we should cooperate as a plastic surgeon to ensure that all trauma patients in Korea are properly treated at the right time, so that the trauma center of Korea is firmly established I hope to catch it.

## Team Surgery with Plastic Surgeon at Emergency Center

Dong Hee Kang

Dankook University, Korea

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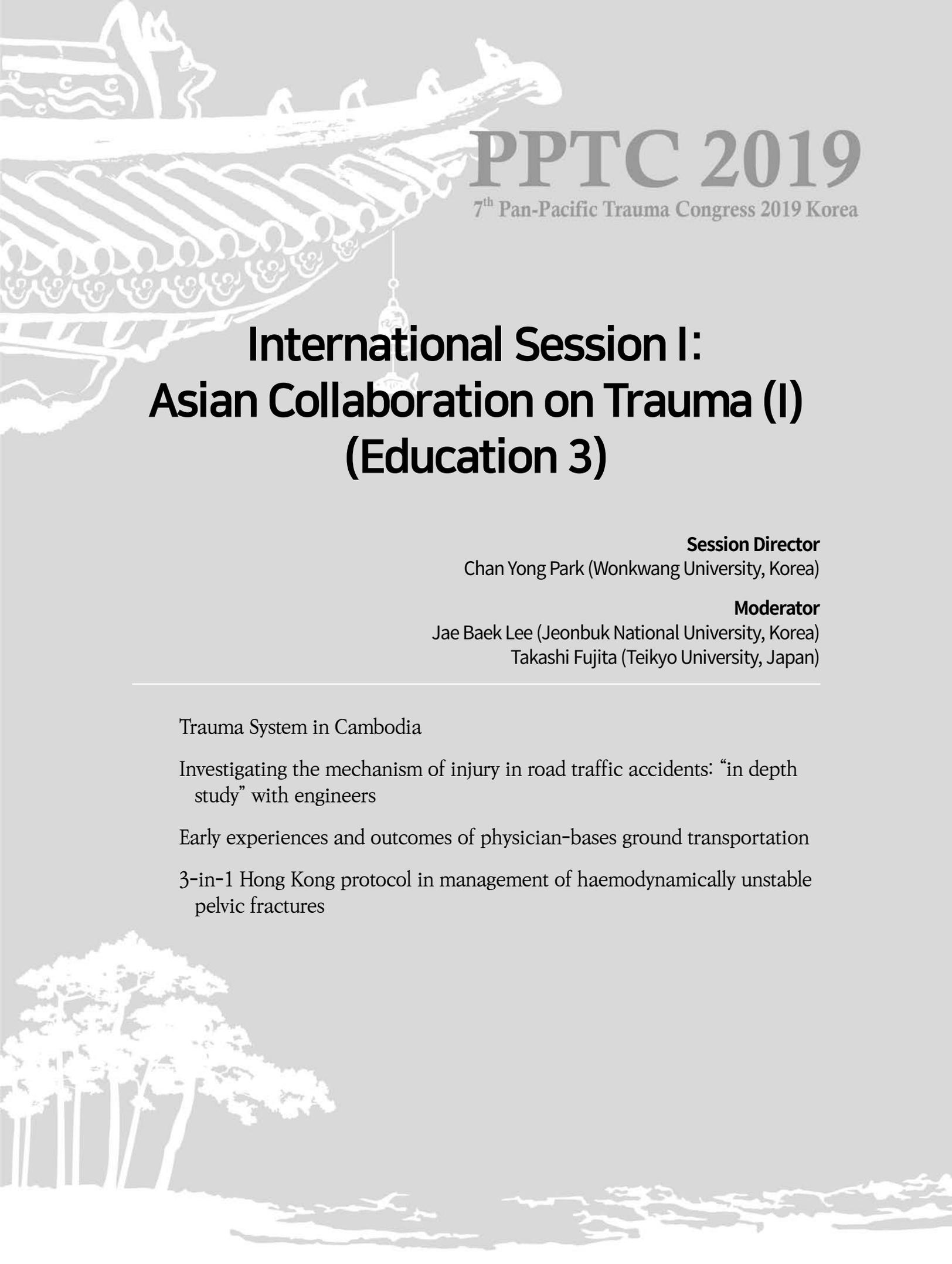
## Plastic Surgery Participation Plan at the Regional Trauma Center

Nam Kyu Lim

Dankook University Hospital, Cheonan

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A law revised in May 2012 provided support to regional and emergency centers for reducing the risk of preventable deaths. In particular, regional trauma centers have been established throughout the nation, with the goal of ensuring that any trauma patient can reach a trauma center within an hour. As a multidisciplinary approach is particularly important in treating severe trauma patients, activation teams are currently organized at each center to perform multiple simultaneous treatments. Under the present system, only 7 departments can participate in these trauma teams; emergency medicine, cardiothoracic surgery, general surgery, orthopedic surgery, neurosurgery, radiology, and anesthesiology. Plastic surgeons also play an essential role in treating trauma patients, and in fact currently treat many such cases. Especially in reconstruction procedures in patients with head and neck trauma and wide tissue defects, plastic surgeons possess unique expertise. However, since plastic surgeons are excluded from the trauma response teams due to institutional limitations, we describe the role and necessity of plastic surgery for trauma and emergency patients, and urge that the system be improved.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## International Session I: Asian Collaboration on Trauma (I) (Education 3)

### **Session Director**

Chan Yong Park (Wonkwang University, Korea)

### **Moderator**

Jae Baek Lee (Jeonbuk National University, Korea)

Takashi Fujita (Teikyo University, Japan)

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Trauma System in Cambodia

Investigating the mechanism of injury in road traffic accidents: “in depth study” with engineers

Early experiences and outcomes of physician-bases ground transportation

3-in-1 Hong Kong protocol in management of haemodynamically unstable pelvic fractures



# Trauma System in Cambodia

Sok Buntha

University of Health Sciences, Cambodia

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## Investigating the Mechanism of Injury in Road Traffic Accidents: “in Depth Study” with Engineers

Mototsugu Kohno

Tsukuba Medical Center Hospital, Japan

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Owing to modern safety technologies, injuries in road traffic accidents are rapidly decreasing especially in vehicle occupants. But it is still a major cause of trauma in many countries. When we see a trauma patient in ER, a history taking will take place to revealing a mechanism of injury. Not only physicians but also policeman, even a lawyer or insurance company want to know how the accident occurred and how the victims injured. I wondered if there is any solution to find out occult visceral injuries.

Our hospital is located in the center of “Tsukuba Science City”, where many institutes and laboratories are gathering. The National Institute for Traffic Accident Research and Data Analysis (ITARDA) and the Japanese Automobile Research Institute (JARI) started a close investigation to selected cases of traffic accidents: “in depth study”, in 1993. Our hospital is designated as an emergency center, so many of those cases are carried by ambulance day by day. And when doctor and nurse drive to the scene with a rapid car, we can see exactly the scene of an accident and the deformity of the vehicles. Then we noticed that there will be some important relationship between the scene information and occult visceral injuries.

Now engineers come to our hospital twice a week to discuss about the relationship between accident mechanism and injuries.

On this presentation, I will introduce our daily activities and how doctors collaborate with engineers. And I will talk about the difference of the interest between doctors and engineers. If we utilize raw information recorded by drive recorder or surveillance camera, we can improve the accuracy of the in depth study. I hope that IT technologies can show a new solution in the field of impact biomechanics and trauma practice.

## Early Experiences and Outcomes of Physician-bases Ground Transportation

Kyu Hyouck Kyoung

University of Ulsan, Korea

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## 3-in-1 Hong Kong Protocol in Management of Hemodynamically Unstable Pelvic Fractures

Mina Cheng

Department of Surgery, Queen Elizabeth Hospital, Hong Kong

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The management of severe pelvic injury remains a challenging task for trauma surgeons. Bleeding can be uncontrollable and patients can die within a short period of time. The mortality rate in patients with haemodynamically unstable pelvic fractures is as high as 40–60%.

There are three bleeding sources. Arterial bleeding only accounts for 10 to 15%, and the rest comes from venous plexus and fractured cancellous bone surfaces.

External fixation helps to reduce bleeding from fractured bone surfaces by reducing fracture fragments and decreasing the geometry of the pelvis.

However, methods for reducing venous bleeding remain to be a controversial issue. In Europe, pelvic packing (pre-peritoneal/ retroperitoneal packing) has emerged as one of the methods for controlling venous bleeding due to tears caused by bony fragments.

Pelvic angio-embolization for controlling arterial bleeding has become popular over the past decades, especially in the United States.

There are frequently concomitant major injuries to other critical organs with the high energy impact of injury. 50% of pelvic fracture patients have sources of major hemorrhage other than pelvic fractures. This complicates the management of pelvic fracture patients.

Protocol driven management has been shown to improve outcomes. It simplifies and shortens the decision making process of a multidisciplinary team in the initial treatment period and decreases mortality in haemodynamically unstable cases.

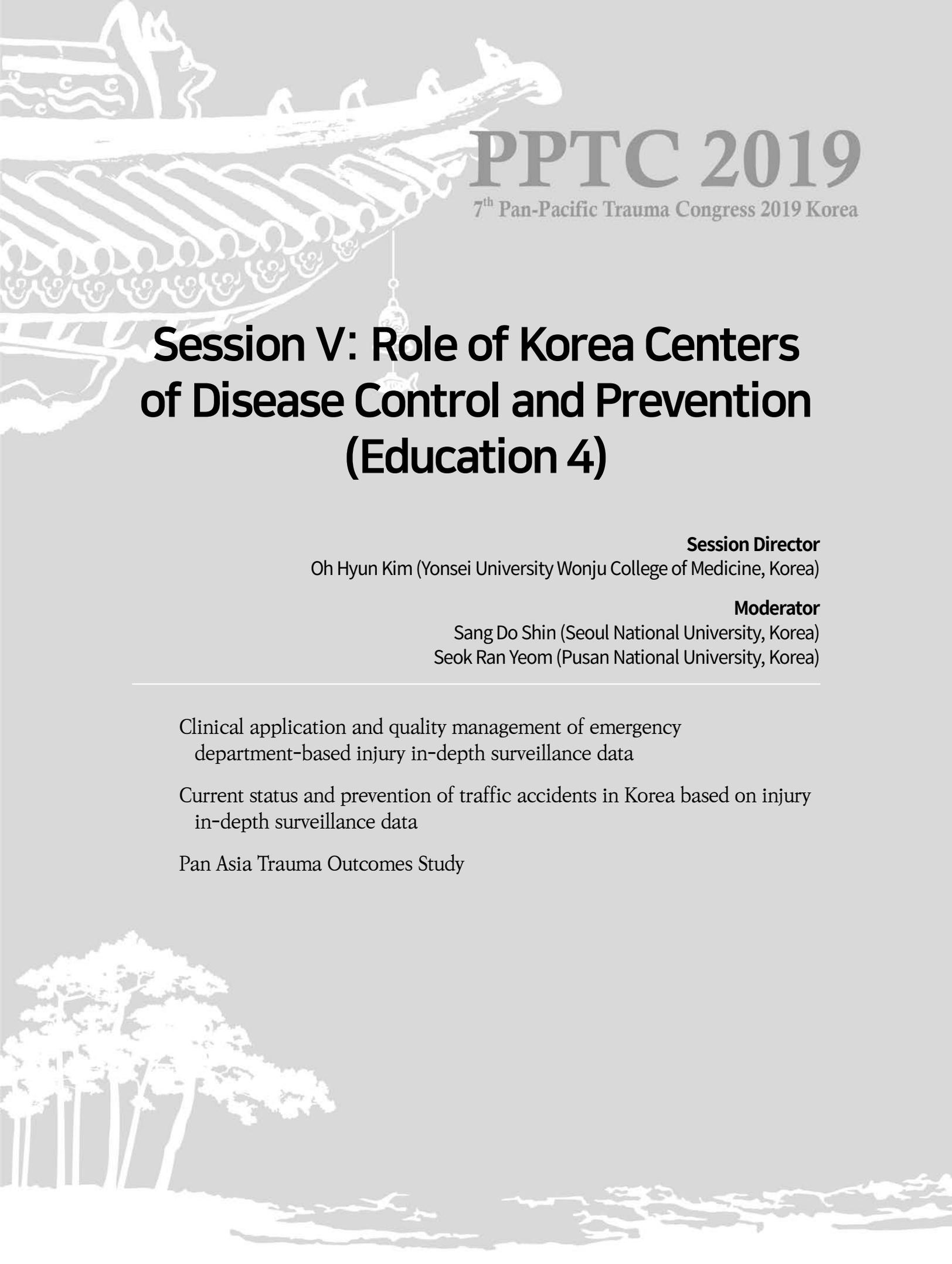
In recent years, angio-embolization and pelvic packing have been introduced to hospitals in Hong Kong as part of a multi-modality treatment for patients with haemodynamically unstable pelvic fractures. These patients with a negative FAST scan were sent to the operation theatre for external fixation by orthopaedic surgeons first, in order to stabilize the disrupted bony pelvis and to limit the pelvic volume to facilitate pelvic packing. This was immediately followed by retroperitoneal packing by trauma surgeons. In the meantime, equipment for angiography and embolisation would be set up in the operation theatre. For patients with a positive FAST scan, they would undergo exploratory laparotomy with the pelvic binder on and the intra-abdominal pathologies would be dealt with first, followed by external fixation and pelvic packing. Angiography and embolisation would follow if necessary.

In the five-year multi-centred review in Hong Kong, patient with haemodynamically unstable pelvic fractures

who had the three-in-one protocol implemented had a statistically significant lower overall, 30-day, 7-day and 24-hour mortality.

In conclusion, the implementation of the three-in-one Hong Kong Protocol in management of haemodynamically unstable pelvic fractures over the years has brought a reduction in mortality. This approach eliminates the often difficult decision point between the operating room and the intervention radiology. The three modalities, namely external fixation, pelvic packing and angio-embolisation, are complementary and supplementary to one another, but not substitutive or competitive.





# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session V: Role of Korea Centers of Disease Control and Prevention (Education 4)

### **Session Director**

Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)

### **Moderator**

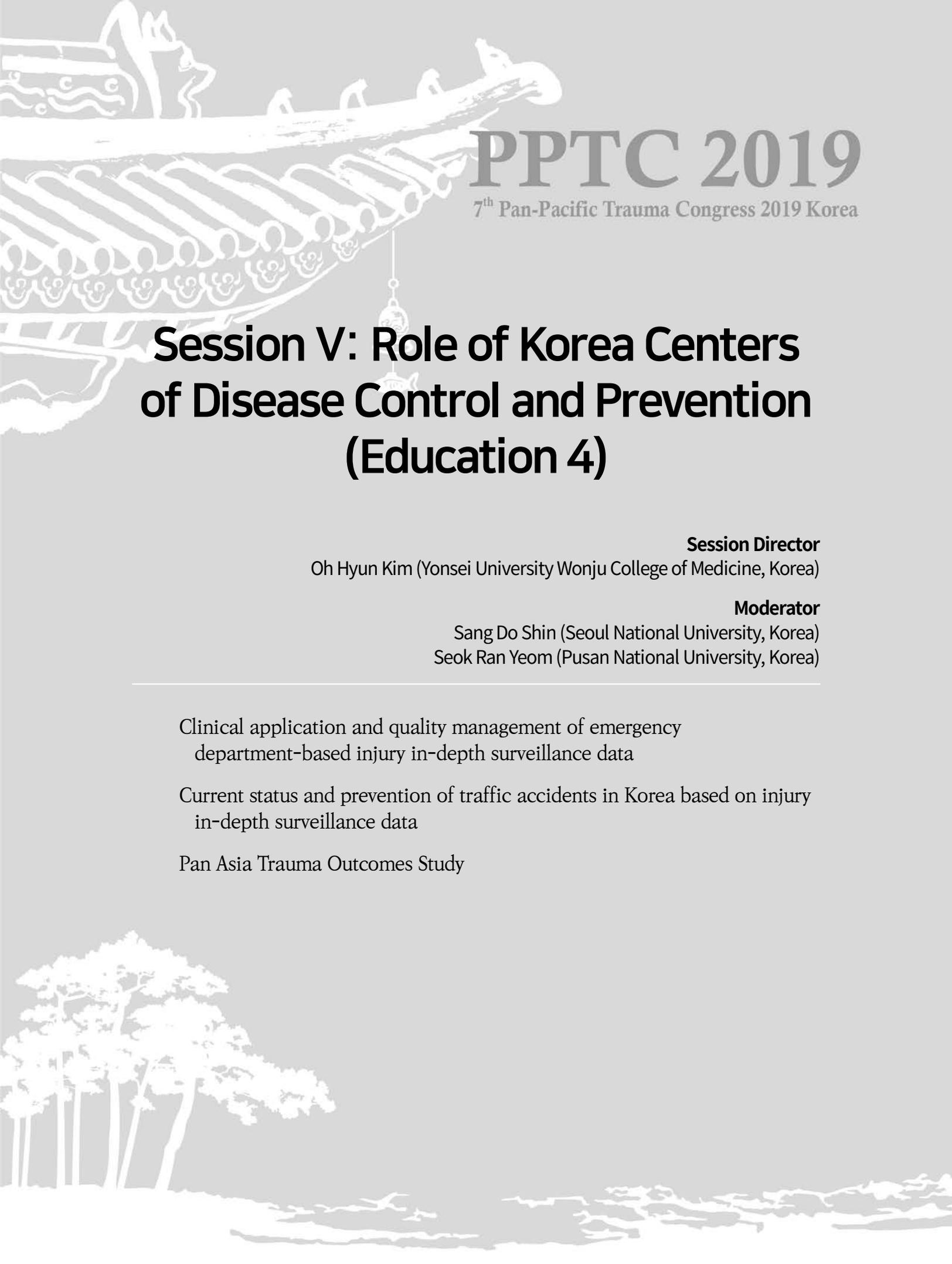
Sang Do Shin (Seoul National University, Korea)  
Seok Ran Yeom (Pusan National University, Korea)

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Clinical application and quality management of emergency  
department-based injury in-depth surveillance data

Current status and prevention of traffic accidents in Korea based on injury  
in-depth surveillance data

Pan Asia Trauma Outcomes Study





# Clinical Application and Quality Management of Emergency Department-based Injury in-depth Surveillance Data

Sung Ok Hong

Korea Centers of Disease Control and Prevention, Korea

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# Past Progress and Future Improvement of EMS-assessed Severe Trauma / Mass Casualty Incident Database

Kyoung-Jun Song

Seoul National University, Korea

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## Pan Asia Trauma Outcomes Study

Sang Do Shin

Department of Emergency Medicine, Seoul National University College of Medicine and Hospital

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The Pan-Asian Trauma Outcomes Study (PATOS) has proposed in 2013 and launched in 2015 led by the Asian Association for Emergency Medical Services (AAEMS). The goal of PATOS was to compare the trauma epidemiology, trauma care, and outcomes in Asian communities. Study subjects are trauma patients who are assessed and treated by emergency medical services program in Asian communities.

The information on demographic, injury epidemiologic, EMS-related, emergency department care, hospital care and outcomes were collected. The primary outcome is the hospital mortality and the secondary is disability measured by Glasgow outcomes scale.

To collect the data, the PATOS clinical research network was constituted for executive committee, five research committee for publication, and advisory committee. Total 11 countries have contributed to the PATOS for the last three years (2015 Dec to 2018 Nov.) Total 74,677 cases (3.2% mortality) were collected from 9 countries' study sites.

Now we finished the phase 1 study and revised the variables for the phase 2 study. The phase 1 data are being cleaned and mined for data transfer to researchers. Using the phase 1 data, we will develop Asian Model for probability of survival and validate the model in each country. We also expect the PATOS will provide the opportunity for comparing the trauma systems and outcomes.





# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## International Session II: Intervention for Penetrating Injury (Education 5)

### **Session Director**

Chang Ho Jeon (Pusan National University, Korea)

### **Moderator**

Hwan Jun Jae (Seoul National University, Korea)

Sung Wook Chang (Dankook University, Korea)

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Management for gunshot wound focusing on intervention

Endovascular intervention in penetrating injury





## Management of Gunshot Wound Focusing on Intervention

Eli Atar

Rabin Medical Center, Petah Tikva, Israel

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Gunshot wound is one of the leading vascular trauma in regular days and in wartime. Endovascular intervention is a minimal invasive option to treat various vascular damages. They enable stabilization for further treatments in multitrauma patients or can be final treatments replacing surgeries.

Trauma team must know the capabilities of their interventional radiology team for better and faster treatments.

The triage is made by CT Angio, both in single trauma patient and in mass casualty trauma patients including during wartime. This imaging triage enables focused treatments at the shortest times for more trauma patients.

The Israeli experience during wartime in CTA triage will be presented as well as demonstrations of various angiographic treatments in vascular traumas.

## Endovascular Intervention for Penetrating Injury

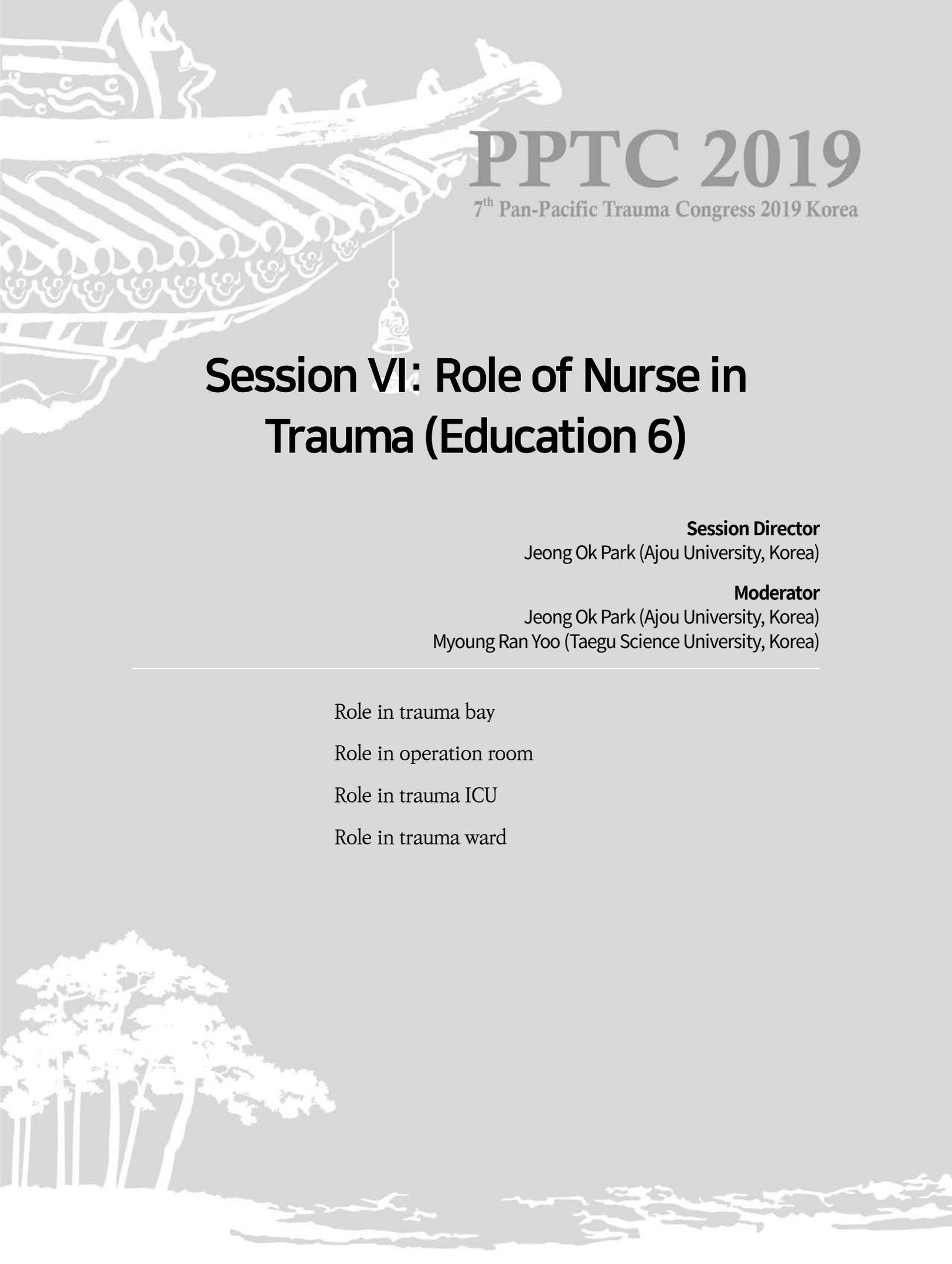
Yosuke Matsumura

Department of Emergency and Critical Care Medicine, Chiba University Graduate School of Medicine,  
Japanese Society of DIRECT, Japan

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Endovascular intervention for penetrating injury includes balloon occlusion, stentgraft, and embolization. Balloon occlusion works as a temporary bridge to hemostasis, while stentgraft and embolization work as definitive hemostasis. Balloon occlusion procedure, including REBOA, selective balloon catheter, and micro-balloon catheter, is a feasible proximal control but it does not occlude distal retrograde flow. It benefits in subclavian-axillary artery, iliac-femoral artery, or retroperitoneal injury, where you may achieve more easily with endovascular technique than via surgical approach. Stentgraft preserves distal perfusion, but it is not always available in many centers. It benefits in main trunk of major arterial injury, where distal flow should not be sacrificed, such as subclavian-axillary artery, common-superficial femoral artery, or renal artery. Embolization is commonly used both in blunt and penetrating injury. It is employed in arterial branch injuries, while cannot be chosen in non-embolizable vessels.

In comparison between blunt and penetrating injury, we can reveal potential indications of endovascular intervention for penetrating injury. 1) Risk of major vessel injury: Penetrating injury has more risk of major vessel injury. In principle of trauma and vascular surgery, “proximal and distal control” is the key step to the definitive surgical hemostasis. Balloon occlusion is a temporary proximal (only) control. It works only in arterial injury and requires fluoroscopy. However, you may reach surgically-difficult vessel injury more quickly by endovascular procedures. 2) Easy identification and tolerance to permissive hypotension: Since injury site can be identified easily, you may focus on specific site in penetrating mechanism. Therefore, there are more chances to utilize endovascular intervention than in blunt polytrauma. 3) Less tissue injury, less coagulopathy: Blunt polytrauma often induces trauma coagulopathy due to tissue injury, while penetrating injury presents less coagulopathy. Less coagulopathy is favorable condition for embolization. As mentioned these nature, endovascular intervention is feasible in penetrating injury.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session VI: Role of Nurse in Trauma (Education 6)

**Session Director**

Jeong Ok Park (Ajou University, Korea)

**Moderator**

Jeong Ok Park (Ajou University, Korea)

Myoung Ran Yoo (Taegu Science University, Korea)

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Role in trauma bay

Role in operation room

Role in trauma ICU

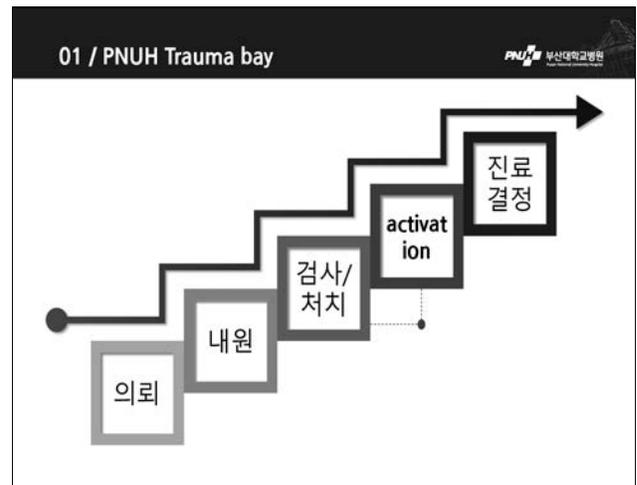
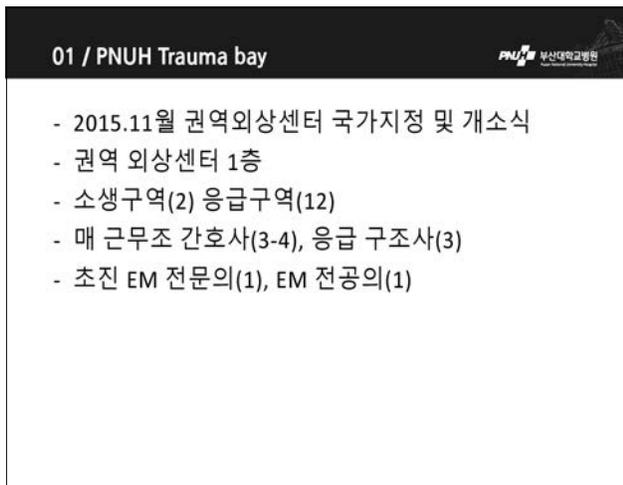
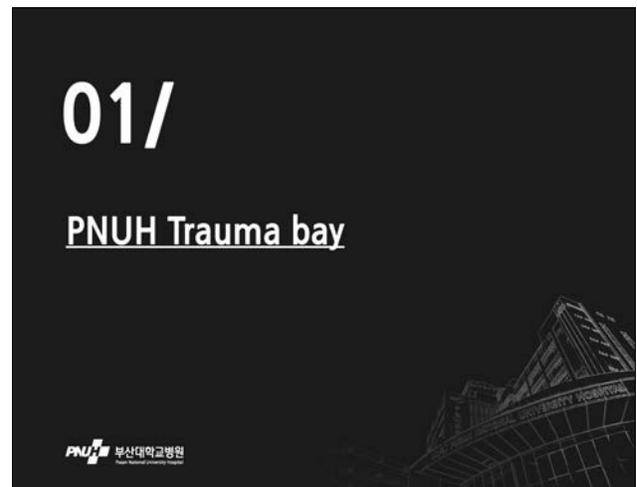
Role in trauma ward



# Role in Trauma Bay

Ji Young Kim

Pusan National University Hospital, Trauma ER, Korea



# "Go Together"

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

### 02 / 의뢰

### 02 / 의뢰

**부산대학교병원 권역외상센터 핫라인**  
 응급의학전문 의 직접 연결  
 핫라인 번호 **010-5184-8911**  
 • 051-240-8911 핫라인 번호 연락 안될 시  
 • 반드시 시간대 후 이용  
 • 외상센터 할기승은 외상센터 별칭 이용

**중증외상외상환자 분류 기준**

01 생리학적 기준	<ul style="list-style-type: none"> <li>APACHE II 점수 &lt; 13</li> <li>수축기혈압 &lt; 90</li> <li>호흡수 &lt; 10 or &gt; 30</li> <li>요통 보조 필요</li> </ul>
02 상해 정도 수상해 위험 기준	<ul style="list-style-type: none"> <li>관통, 자상, 동요기출, 담개</li> <li>손목, 발목 상부의 골절</li> <li>골절: 골절, 두 개 이상 인체</li> <li>마비</li> </ul>
03 손상기전에 따른 기준	<ul style="list-style-type: none"> <li>낙상</li> <li>고위험 교통사고</li> <li>오르막이 사고</li> <li>폭발에 의한 직접적 영향</li> </ul>
04 외상상태 및 특수상황 (의료지도 불수)	<ul style="list-style-type: none"> <li>55세 1, 15세 1, 임신 20주 1</li> <li>항문고 출혈상, 골기상정찰상</li> <li>화상과 외상이 동반</li> <li>구급대원의 판단</li> </ul>

→ 기준편의 여자를 경우 즉시 부산광역시외상센터 핫라인으로 연락

### 03 / 내원

**2018년 환자 성별**

25% (남) 75% (여)

**2018년 환자 연령**

연령대	남	여
초·아·청소년	69	25
20대	97	33
30대	93	18
40대	132	27
50대	244	40
60대	230	51
70대 이상	174	127

### 03 / 내원

**2018년 환자 내원 수단**

내원 수단	비율
119구급차	0.58%
의료기관/기타 구급차	1.24%
항공이송	48.98%
기타	49.18%

### 03 / 내원

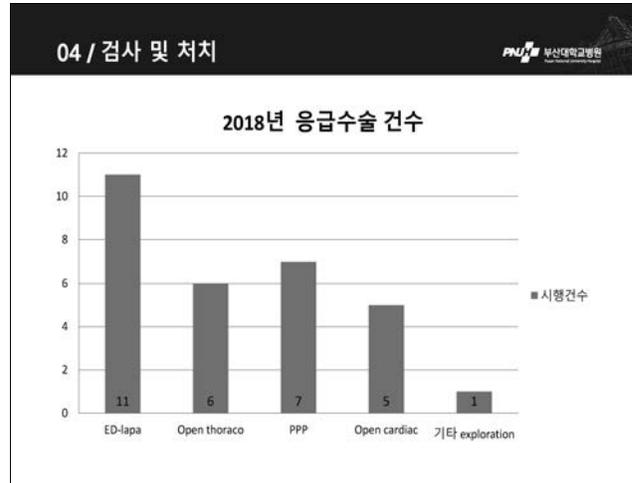
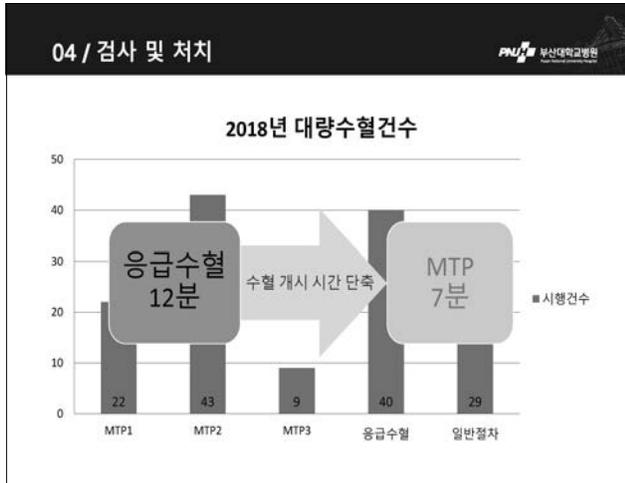
**2018년 손상기전**

손상기전	건수
보행자 TA	238
자동차 TA 운전자 또는 동승자	193
오토바이 TA	170
자전거 TA	31
기타	35

667 (교통사고) → 362 (추락) → 75 (미끄러짐) → 111 (물체에 맞음) → 80 (날카로운것에 의한 손상) → 14 (기계에 의한 손상) → 6 (기타) → 49 (미상)

### 04 / 검사 및 처치

	응급수혈	MTP
수혈전 검사단계	- ABO/RhD 혈액형 검사	- 모두 생략
불출가능 혈액	- 검사결과에 따른 혈액형	- O+의 pc 제재 - AB+의 FFP /c PLT
검체 채취	- 반드시 필요	- 가능한 채취
본원 소요 시간	- 평균 12분	- 평균 7분



### 05 / Activation

#### 측정대상 선별기준

1) **외상팀 활성화 기준 대상자**: 해당 기관으로 내원한 환자 중 외상팀 활성화가 필요한 환자  
 - 다음 3가지 조건 중 1개 이상 해당하는 경우

- 외상동특체계 [내원 시 활력징후\_수축기혈압]

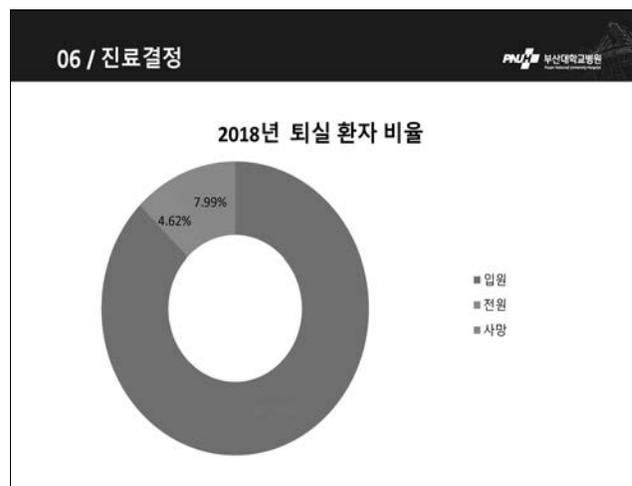
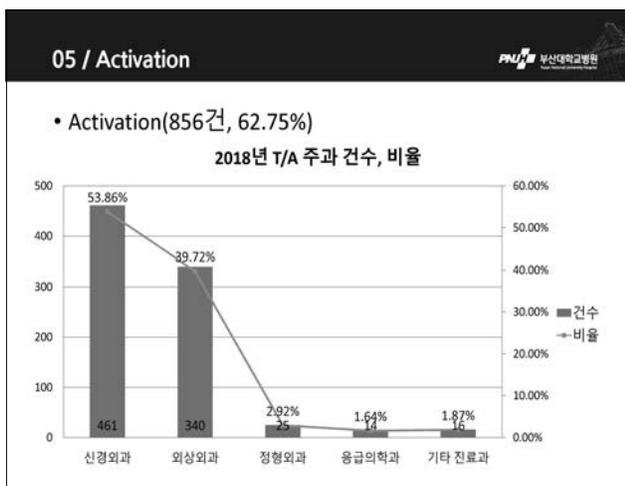
연령(세)	수축기혈압(mmHg)
< 1	< 60
1 - 10	< 70 + (2 × 연령)
> 10	< 90

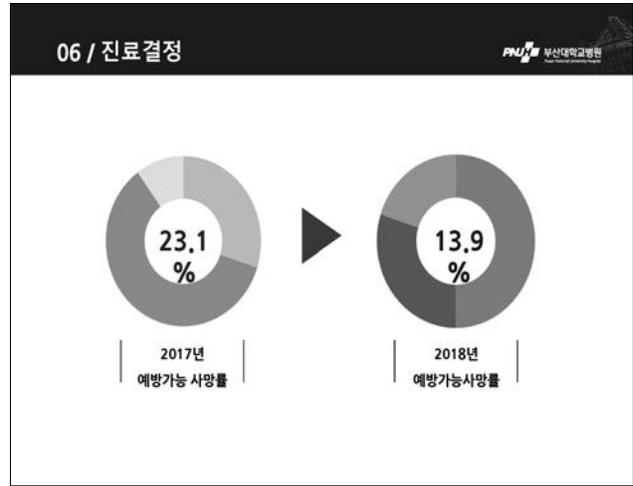
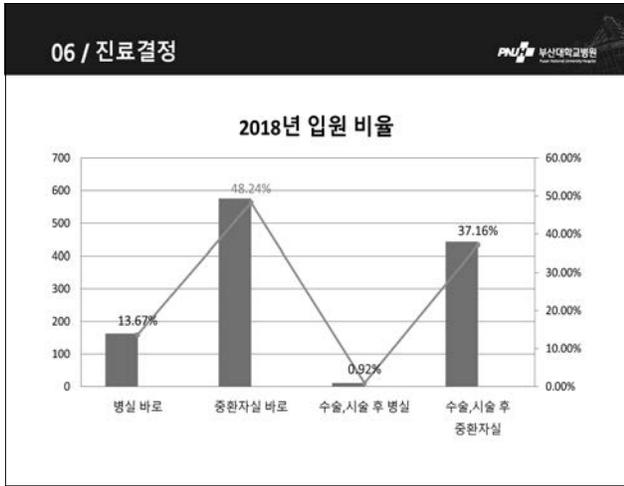
- 수축기혈압 미상 제외
- 외상동특체계 [내원 시 활력징후\_호흡] = 호흡 수 < 10회/분 또는 호흡 수 > 29회/분
- 15세 미만 제외
- 외상동특체계 [내원 시 GCS(전체)] = 3 - 13 또는 [내원 시 GCS(전체)] 미상인 경우 [내원 시 의식상태] = Painful response, Unresponsive
- 외상동특체계 [응급진료결과] = 사망(41, 42, 43) 제외

### 05 / Activation

- 최소활성화 팀 : 응급의학과(1), 외상외과(3), 신경외과(1)
- on call: 영상, 마취과, 정형외과 각과 전문의
- 외상팀

A팀 : GS
B팀 : TS
중환자팀





## Role in Operation Room

Je Yung Mun

AJOU University Hospital, Korea

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The trauma operating room of Ajou University Hospital opened in March 2016 consists of three rooms and has personnel and equipment that can perform surgery for severe trauma patients 24 hours a day, 365 days a year. It has an average of 2600 surgeries per month on an average of 250 cases per month, which plays an important role in patient recovery. We maintain emergency response system that can arrive within the shortest one minute from the helipad on the 14th floor of the main building to the operating room. The trauma operating room consists of 19 staff nurses and one head nurse and works in three shifts of the year. Orthopedic surgery accounts for two-thirds of the surgery, followed by neurosurgery, trauma surgery, and plastic surgery. In addition, about 60% of all operations are emergency operations, and in addition to regular hours, the operating room share is about 25%. For emergency surgery, 141 sets are constructed and used with over 15,000 surgical instruments. It's maintenance is also one of the important tasks. Since trauma patient surgery should be performed accurately in a short time, the manual was created through several simulations at the beginning of the opening session. In order to ensure patient safety, the operation patient and the operation site are confirmed in four stages in emergency situations. Above all, we use count sheet and packing material note as a way to prevent foreign matter residue in the body, and computerized recording system is also in development stage. In order to improve the quality of surgical nursing, it is required to complete the beginner, intermediate and advanced courses of trauma patients, and it is also actively utilizing education to be conducted outside the surgical nursing society.

## Role in Trauma ICU

Bo-Kyung Kim

Wonju Severance Christian Hospital trauma ICU, Korea

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Most trauma patients are often accompanied by complex problems, so basic care for life support and assessment, treatment, and nursing activities must be done at the same time.

The purpose of this study was to identify the characteristics of injured ICU patients and to discuss the competencies and qualities of nurses in the ICU nursing department in order to carry out appropriate nursing care.

# Role in Trauma Ward

정 소 영

가톨릭대학교 의정부성모병원

## Contents

Role in trauma ward

- 01 외상병동 운영
- 02 병동 외상환자 이해
- 03 외상환자 간호

### 01 외상병동 운영

2018  
권역외상센터  
운영지침

**4) 외상병실**

가) 외상센터의 외상병실은 외상환자만을 수용하여야 한다.

나) 외상병실의 환자 입·퇴원은 전담전문의가 결정한다.

보건복지부

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PPTC

### 01 외상병동 운영



중환자실치료의 마무리 과정과 사회로의 복귀 준비가 이루어지는 곳

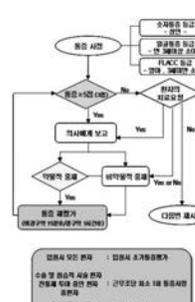
Pain	Delirium	Rehabilitation
<ul style="list-style-type: none"> <li>▪ Active pain control</li> </ul>	<ul style="list-style-type: none"> <li>▪ Pharmacological treatment</li> <li>▪ Information and support</li> </ul>	<ul style="list-style-type: none"> <li>▪ 1단계 : Passive ROM</li> <li>▪ 2단계 : Active ROM</li> <li>▪ 3단계 : Sitting</li> <li>▪ 4단계 : Standing</li> <li>▪ 5단계 : Walking</li> </ul>

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PPTC

### 01 외상병동 운영

#### ❖ 통증 관리



구분	구분	구분	구분
1	2	3	4
5	6	7	8
9	10	11	12

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# "Go Together"

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### 01 외상병동 운영

#### Delirium

**Clinical indicators that can contribute to delirium**

Factor	Preventive intervention
Consciousness and/or disorientation	Multiple medications Identify and manage underlying causes or combinations
Pain	Brain effective communication and documentation, quantify Consider non-drug therapy, friends and family to help with it
Dehydration and/or constipation	GOAL DIRECTED SEDATION STEP 1: ASSESS & MANAGE PAIN (use 4-6 step approach to pain management)
Hypoxia	POUR OUTLINE CRITICAL ADJUSTMENT GOAL: O2 SAT ≥ 95% GOAL: RR ≤ 20 GOAL: SpO2 ≥ 95% GOAL: MAP ≥ 65
Infection	Sensory impairment Identify and manage underlying causes or combinations Identify and manage underlying causes or combinations
Insomnia or or altered mobility or	Sleep disturbance Identify and manage underlying causes or combinations

**Evaluation for new-onset delirium**

**Initial assessment**

- Vital signs, neuro exam
- SST/Inorganic glucose
- Review medication list
- Review recent events/procedures

**Labs: consider depending on context\***

- Electrolytes including Ca/Mg/Phos
- CBC with differential
- ABU/AVG only if hypercapnic encephalopathy likely
- TSH
- LFTs, ammonia
- Relevant drug levels (e.g. lithium, digoxin, theophylline)
- Carbonophenol level for new presentation in winter
- Additional toxicological workup as appropriate

**Consider CT head especially if\***

- Anticoagulated
- Trauma
- Acute/severe headache
- Focal abnormality on exam
- Substantially reduced level of consciousness

**Consider LP especially if\***

- Delirium is chief complaint on admission
- Evidence of infection (fever, leukocytosis, nuclear rigidity)

**Consider EEG especially if\***

- History of seizure
- Exam concerning for nonconvulsive status

\*Delirium is very common in the ICU and not every patient needs a ton of tests. More aggressive workup needed if rapid & major change in mental status, delirium is the presenting problem to hospital, no obvious cause for delirium, no prior history of delirium/dementia.

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### 01 외상병동 운영

#### Delirium

**Environment : Information and support**

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### 01 외상병동 운영

#### 중환자실 재활 - 호흡 재활

**중환자실에서의 재활치료**  
복합학부 외상외과 재활치료팀  
Woo Kim, MD  
Department of Rehabilitation Medicine, Inje Medical Center, University of Inje College of Medicine, Inje, Korea

**Rehabilitation in Intensive Care Unit**

**재활적용이 불가능한 대상 환자**

- ✓ 개방성 복부창상
- ✓ 활동성 출혈
- ✓ 뇌압 상승
- ✓ 마비, 골절 등

외상환자

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### 01 외상병동 운영

구분	구분	재활목표	재활수단	평가방법	평가시기	평가인원	비고
1차	1차	1차	1차	1차	1차	1차	1차
		2차	2차	2차	2차	2차	2차
		3차	3차	3차	3차	3차	3차
		4차	4차	4차	4차	4차	4차
		5차	5차	5차	5차	5차	5차
		6차	6차	6차	6차	6차	6차
		7차	7차	7차	7차	7차	7차
		8차	8차	8차	8차	8차	8차
		9차	9차	9차	9차	9차	9차
		10차	10차	10차	10차	10차	10차

1단계	Passive ROM	<ul style="list-style-type: none"> <li>• Bed side PT</li> <li>• CPM(continuous passive motion)</li> </ul>
2단계	Active ROM	<ul style="list-style-type: none"> <li>• Head up 60도 이상</li> <li>• (기구 이용)상지 근력 운동</li> </ul>
3단계	Sitting	<ul style="list-style-type: none"> <li>• 고무줄(끈) 잡아당겨 일어나기</li> <li>• 무릎 세워 엉덩이 들기</li> <li>• 침상 걸터앉기</li> <li>• 휠체어 타기</li> </ul>
4단계	Standing	<ul style="list-style-type: none"> <li>• 누워서 다리 들기</li> <li>• 스퀴트</li> <li>• 보조기구 이용해 서기</li> </ul>
5단계	Walking	<ul style="list-style-type: none"> <li>• 보조기구 이용해 걷기</li> </ul>

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### 01 외상병동 운영

#### RESOURCES

**Prehospital** | **Inpatient Trauma Care** | **Postacute Care**

**TRAUMA DATA COLLECTION** | **TRAUMA DATA ANALYSIS**

**TRAUMA SYSTEM PERFORMANCE IMPROVEMENT**

Home preparation, Discharge from hospital with plans for follow-up care, Home with or without rehabilitation, Inpatient rehabilitation facility, Community reintegration plans in place.

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### 01 외상병동 운영

Step down unit or general surgical floor for continued care

Community reintegration plans in place

Discharge from hospital with plans for follow-up care

Home with or without rehabilitation

Inpatient rehabilitation facility

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**03 외상환자 간호**

### 자살 고위험군

**Suicide**  
Gallagher, Egan and Henington

Panel: Risk factors for suicide

**Distal**

- Genetic loading
- Personality characteristics (eg, impulsivity, aggression)
- Restricted fetal growth and perinatal circumstances
- Early traumatic life events
- Neurobiological disturbances (eg, serotonin dysfunction and hypothalamic-pituitary axis hyperactivity)

**Proximal**

- Psychiatric disorder
- Physical disorder
- Psychosocial crisis
- Availability of means
- Exposure to models

사회 경제적 수준이 급격히 추락하는 경우  
**Depression**

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**03 외상환자 간호**

### 자살 예방 활동

제21회 외상부상학회  
학계·자살 치료 및 예방 프로그램  
2019년도 춘계 심포지움  
(주제: 자살의 최근 동향과 대안)

요청사항(상세)

PROGRAM

7:00-7:30 등록 / 7:30-7:45 개회식 / 7:45-8:00 제21회 외상부상학회 춘계 심포지움 개회식 / 8:00-8:30 제21회 외상부상학회 춘계 심포지움 주제 발표 / 8:30-9:00 제21회 외상부상학회 춘계 심포지움 주제 발표 / 9:00-9:30 제21회 외상부상학회 춘계 심포지움 주제 발표 / 9:30-10:00 제21회 외상부상학회 춘계 심포지움 주제 발표 / 10:00-10:30 제21회 외상부상학회 춘계 심포지움 주제 발표 / 10:30-11:00 제21회 외상부상학회 춘계 심포지움 주제 발표 / 11:00-11:30 제21회 외상부상학회 춘계 심포지움 주제 발표 / 11:30-12:00 제21회 외상부상학회 춘계 심포지움 주제 발표

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**03 외상환자 간호**

### 저소득 전 자 산업 재해 근로자 지원 사업

한국장애인고용공단

2018년도 전담가정지원센터 사업안내

사랑의열매

다. 긴급위기가족지원

1) 단계별 지원방안

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**03 외상환자 간호**

### Effective Intervention

- Patient
  - Peer-based support : Peer mentoring
  - Group support
- Family care
  - Listen : Family stories
  - Hear : Personal meaning
  - Educate : system, trauma, family response

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**03 외상환자 간호**

**ATS**  
AMERICAN TRAUMA SOCIETY

INDIVIDUAL MEMBER TYPES

- EMT/Paramedic
- Government Official (Local, State or Federal)
- Injury Prevention Professional
- Nurse
- Physician or Resident
- Full Time Student or Retired Professional
- Health Services Executive
- Performance Improvement Professional
- Trauma Program Manager
- Trauma Registry/Data Professional
- Other Professional or Public Member
- TSN Peer Visitor
- Trauma Survivor  
(Free resources for trauma survivors and their families through our Trauma Survivors Network Program)

INSTITUTIONAL MEMBER TYPES

- Hospital or Trauma Center
- Non-Trauma Center or Rehabilitation Facility
- EMS Squad, Ambulance Service or Fire Department

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**03 외상환자 간호**

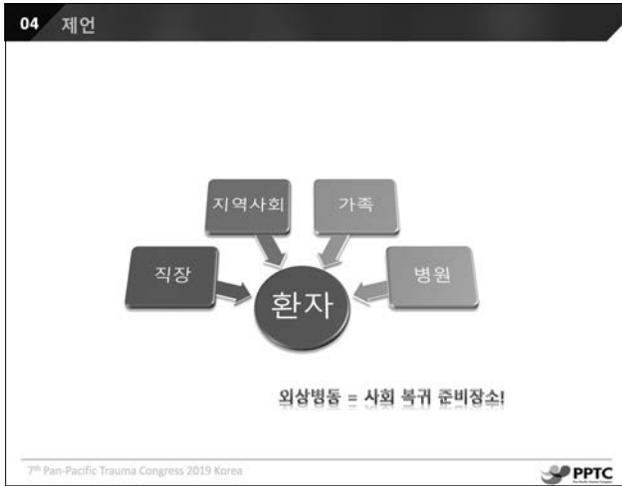
trauma survivors  
**network**  
provided by ATS

**ATS**  
AMERICAN TRAUMA SOCIETY

Upon completion of the Trauma Survivor Network Coordinator Course, the learner will be able to:

- Recognize the history and overview of the Trauma Survivors Network (TSN) program, its relationship with the American Trauma Society, and the benefits of implementing the TSN program.
- Discuss best practices for implementing both inpatient and outpatient TSN services, including a PTSD screening program.
- Define correlation between TSN services and evidence based research in Trauma Informed Care, Patient and Family Centered Care, Peer to Peer Support, and Acute Stress Disorder/Posttraumatic Stress Disorder within the trauma population.
- Identify strategies to encourage stakeholder buy-in, cultivate physician and trauma team champions, and promote and fundraise for the TSN program.
- Increase knowledge on best practices to recruit and train trauma survivors and family members to participate as TSN Peer Visitors, increase knowledge on incorporating student interns as part of the TSN Team.
- Discuss approaches that engage survivors, families, and trauma professionals in National Trauma Survivors Day, Trauma Awareness Month, and various Trauma Champion Events.
- Recognize the national partnership between Hanger/AMPOWER and ATS/TSN and how to best collaborate with local AMPOWER peer visitors to help support building a TSN Peer Visitation program.

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea







# PPTC 2019

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## International Session III: International Trauma Study (Education 7)

### **Session Director**

Chan Yong Park (Wonkwang University, Korea)

### **Moderator**

Yang Bin Jeon (Gachon University, Korea)

Hang Ju Cho (Uijeongbu St. Mary's Hospital, Korea)

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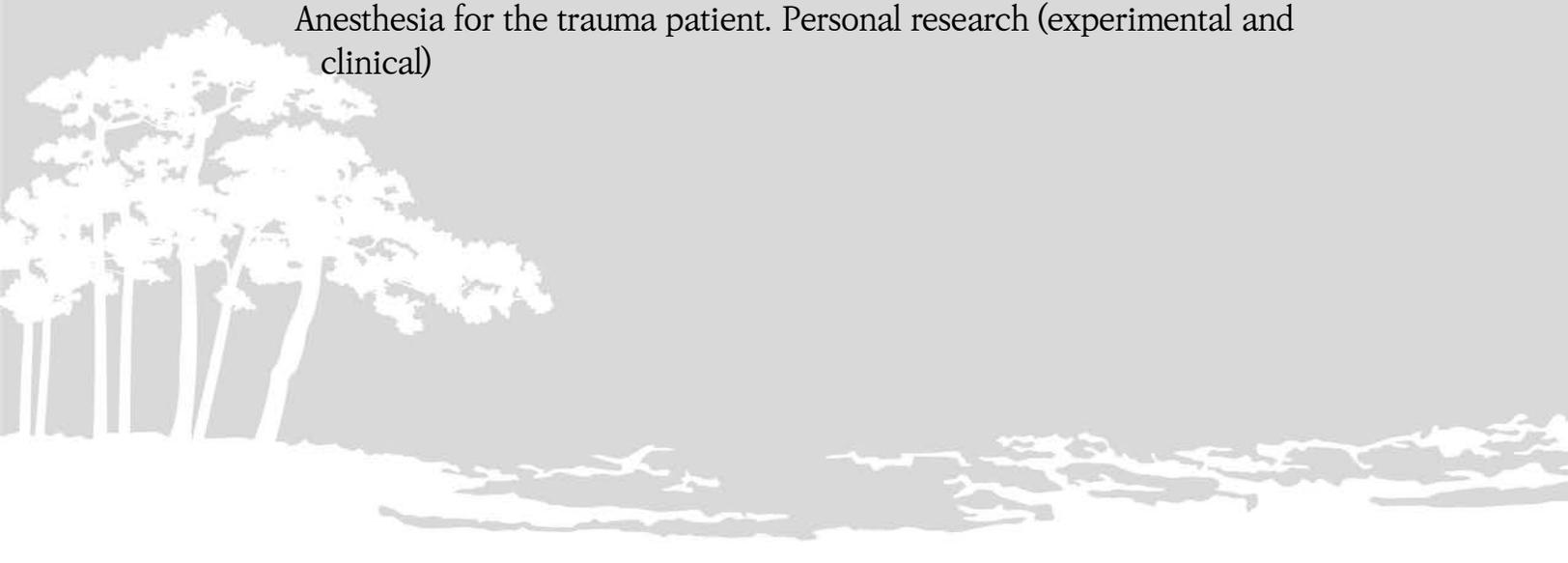
Keynote High mobility group box 1 protein in trauma

1) HMGB1 increases after pulmonary contusion in a combat-relevant polytrauma model

2) Expression of HMGB1 in a polytrauma model treated with ECLS at ground level and high altitude

Management of Trauma in austere environment-Experience in Sri Lanka

Anesthesia for the trauma patient. Personal research (experimental and clinical)





# High Mobility Group Box 1 Protein in Trauma

Jae Hyek Choi

The Geneva Foundation, Tacoma WA, United States Army Institute of Surgical Research,  
JBSA Ft. Sam Houston, TX

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## Background

Acute respiratory distress syndrome (ARDS) occurs after trauma, inhalation injury, infection, massive transfusions and burns. Extracorporeal life support (ECLS) is used to support ARDS patients in whom mechanical ventilation has failed or during transport including during aeromedical evacuation (AE). ECLS patients must be closely monitored during flight as changes in atmospheric pressure, oxygen content, and temperature fluctuation may affect stability and outcome. Chest trauma and pulmonary contusion (PC) are common complications after injury sustained in combat and civilian settings. High mobility group box 1 (HMGB1) protein is a known damage associated molecular pattern (DAMP) but has not been studied during ARDS and trauma treated with ECLS in a chest contusion and high-altitude environment. Other damage indicators such as plasma-free Hemoglobin (pfHb) is a molecule released when red blood cells are hemolyzed, as commonly occurs at low levels in ECLS. We investigated expression of HMGB1 and pfHb in a combat-relevant polytrauma/ARDS model of AE with ECLS. We hypothesized that PC causes an increase in HMGB1 and pfHb concentration after injury and that exposure to high altitudes experienced during AE would increase DAMP expression.

## 1) HMGB1 increases after pulmonary contusion in a combat-relevant polytrauma model

### Methods

Female Yorkshire swine ( $52.57 \pm 2.01$  kg,  $n=10$ ) were anesthetized, mechanically ventilated, and received arterial and venous catheters, tracheostomy, and round-the-clock intensive care for 24 hours or until death. After baseline (BL) stabilization a unilateral right-sided PC was carried out using a modified captive-bolt humane stunner (Model ML, Karl Schermer, Packers Engineering, Omaha, NE). Following PC, animals were hemorrhaged (12.0 mL/kg) via a manual withdrawal of blood from an arterial line. Plasma samples were collected at BL, post-hemorrhagic shock (PS), and at 3, 6, 12, and 24 hours post-transfusion. ELISA (IBL international, ST51011, NC, US) was utilized to analyze HMGB1. pfHb was measured by Spectramax i3 (molecular device, CA, US). TPP was measured by Pierce™ BCA protein assay kit (ThermoFisher Scientific, NY, US). Statistics by SAS Cary, NC, v. 9.4. Statistical significance was established at  $p < 0.05$ ; data are represented as mean  $\pm$  SEM.

## Results

HMGB1 concentration increased above BL levels ( $7.7 \pm 2.4$  ng/mL) at PS ( $14.8 \pm 3.9$  ng/mL,  $p < 0.05$ ), 3 h PI ( $43.0 \pm 29.4$  ng/mL,  $p < 0.05$ ), and 6 h PI ( $9.2 \pm 3.1$  ng/mL,  $p < 0.05$ ). TPP concentration decreased at all timepoints following BL ( $6.3 \pm 0.3$  g/dL) at PS ( $5.6 \pm 0.3$ ), 3 h ( $5.3 \pm 0.4$ ), 6 h ( $4.9 \pm 0.2$ ), 12 h ( $4.9 \pm 0.2$ ), and 24 h ( $4.4 \pm 0.2$  mg/dL). pfHb concentration did not change.

## 2) Expression of HMGB1 in a polytrauma model treated with ECLS at ground level and high altitude

### Methods

Female Yorkshire swine ( $54.17 \pm 1.27$  kg) ( $n=15$ ) were anesthetized, mechanically ventilated, received arterial and venous catheters, tracheostomy, and round-the-clock intensive care. After baseline (BL) stabilization, animals were cannulated with a 23F Avalon dual lumen catheter and veno-venous ECLS was initiated (CardioHelp, Maquet GmbH, Gettinge Group, Rastatt, Germany) via right jugular vein. Systemic heparinization was utilized to maintain elevated activated clotting time levels (150% of BL level) on day 1. Animals underwent a simulated transport, modeling a typical AE, from the animal ICU to an adjacent building housing the altitude chamber. During the flight, animals were exposed to a flight profile consisting of 5,000 Ft, 8,000 Ft, 30,000 Ft altitudes. After the first day flight, animals were returned to the animal ICU via the same transport scenario where they were maintained overnight under ICU care with full anesthesia and sedation. At midnight of the overnight stay, continuous heparin was withdrawn in preparation for the injury. On day 2, all animals received an injury consisting of bilateral pulmonary contusion (PC), using a modified captive-bolt stunner (Model ML, Karl Schermer, Packers Engineering, Omaha, NE) before being subjected to the same simulated AE as on day one. Blood was collected at BL, post-ECLS cannulation (PE), at sea level, 5,000 Ft, 8,000 Ft, 30,000 Ft, post-flight after returning to the ICU, 12 hours PE, immediately pre-injury (Pre) and post-injury (PI), and at each altitude as on day 1. ELISA (IBL international, ST51011, NC, US) was utilized to analyze HMGB1 plasma concentration. pfHb was measured by Spectramax i3 (molecular device, CA, US). Statistics by SAS Cary, NC, v. 9.4. Data are represented as mean  $\pm$  SEM.

### Results

Six animals died after injury and only completed Day 1 flight (non-survivor group). In these animals, HMGB1 was higher at PI compared to the survivor group ( $110.2 \pm 45.7$  ng/mL vs  $45.1 \pm 9.6$  ng/mL,  $p < 0.05$ ). Similarly, pfHb differed between groups at PI ( $43.6 \pm 6.9$  mg/dL vs  $23.2 \pm 3.1$  mg/dL,  $p < 0.001$ ), 30,000 ft ( $21.6 \pm 3.9$  mg/dL vs  $10.7 \pm 1.9$  mg/dL,  $p < 0.05$ ), and Pre ( $39.1 \pm 4.8$  mg/dL vs  $26.1 \pm 4.2$  mg/dL,  $p < 0.05$ ). pfHb increased for the non-survivor group from BL levels PI ( $43.6 \pm 6.9$  mg/dL vs  $24.0 \pm 5.0$  mg/dL,  $p < 0.05$ ).

### Conclusions

PC led to a transient increase in HMGB1 levels and a sustained decrease in TPP. We conjecture that bedside assessment of DAMPs confirms injury and may provide a useful monitoring capability at point of care. Exposure to high altitude alone does not alter HMGB1 expression in uninjured state on ECLS. Pulmonary contusion causes a

transient increase in HMGB1. Bedside assessment of HMGB1 and pfHb confirms injury and may provide a useful monitoring capability during en-route care and should be a part of precision medicine lab-on-a-chip type assays in the future.

## Management of Trauma in Austere Environment-Experience in Sri Lanka

Kamal Jayasuriya

College of Surgeons, Sri Lanka

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Sri Lanka has a good network of hospitals and transport system from primary care level to the tertiary care. At present there no special trauma centres all over the country to cover the population except a few. The range of injuries are different and unique to the island are being manage using the available health system. Our health is completely free of charge. It is important to share our different experience with the international trauma family. Austere standard trauma care is a challenge for us.

## Anesthesia for the Trauma Patient. Personal Research (Experimental and Clinical)

Carlos L. Errando

Department of Anesthesiology, Critical Care and Pain Therapy, Consorcio Hospital  
General Universitario de Valencia, Valencia, Spain

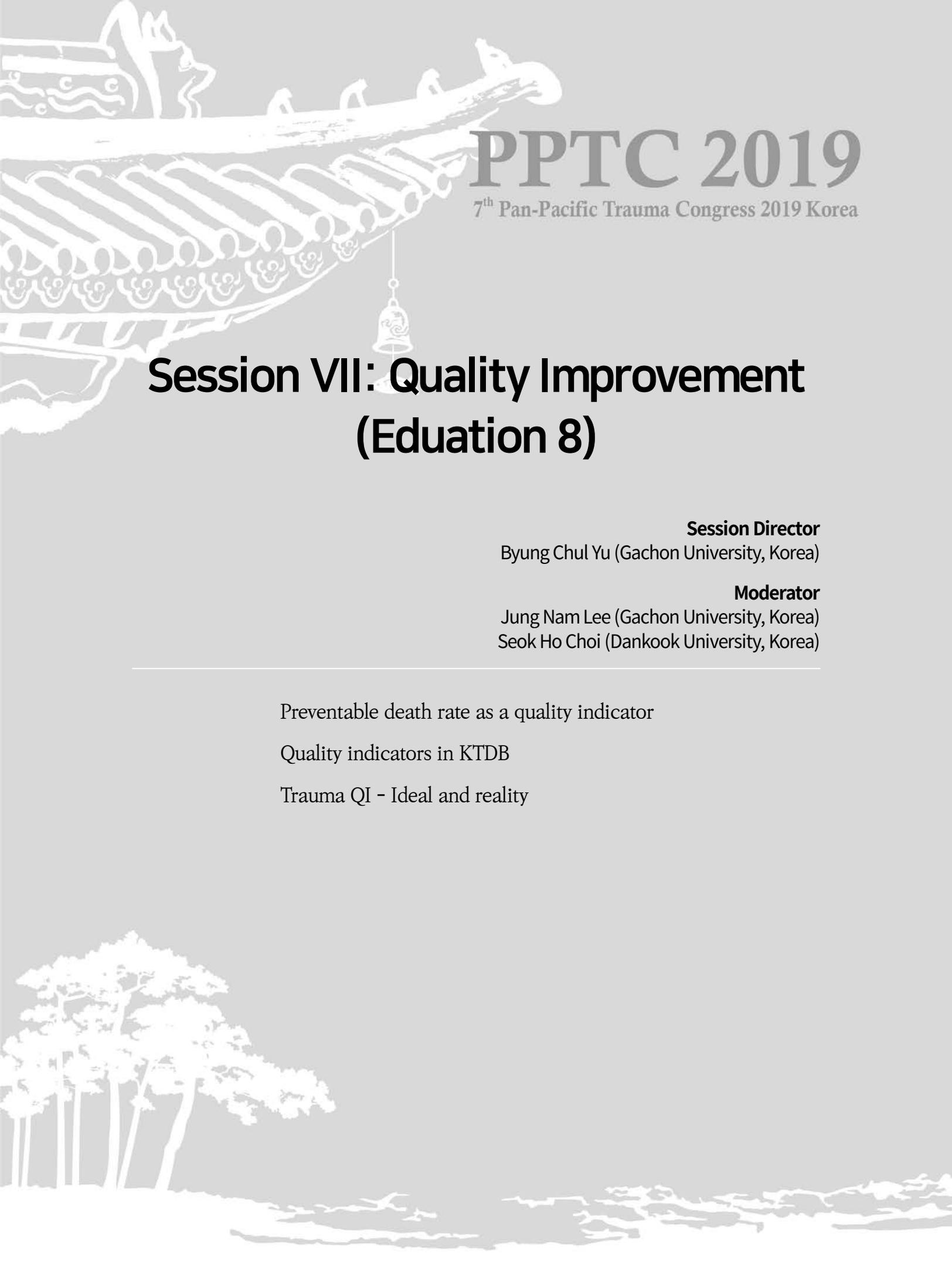
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**Introduction:** The lecture would emphasize the personal interest of the author in several aspects of trauma anesthesia and related fields. All studies were published in available scientific journals (PubMed).

**Methods and Results:** In 1996 my Doctoral Thesis was presented on anesthesia induction in an animal model of hypovolemia. A clinical approach in healthy patients was performed afterwards. This approach, consisting in total intravenous anesthesia based in midazolam-ketamine-vecuronium, was included since in the hospital protocol for trauma patients (and the hemodynamic unstable ones). A hypothesis was presented in 1999, based in the fact that spinal anesthesia is usually not indicated in trauma patients. several investigations were carried out to investigate if ketamine was suitable for this indication. First, toxicity studies were performed in pigs and rabbits. Results showed none or low toxicity of the drugs. Afterwards, subarachnoid ketamine was studied in a model of acute hypovolemia in pigs. The results were promising. However, our busy clinical activity precluded us to follow this investigational line. Since then, clinical studies have followed up. In 2008, an important study on intraoperative awareness during general anesthesia was published. Emergency anesthesia was related with higher incidence of awareness. In 2009, the Spanish guidelines (the first published worldwide) on perioperative neuromuscular blockade management and reversal were published, the author being main coauthor. In the civil life, anesthesia for the very elderly trauma patient is frequent and is growing. Spinal anesthesia is a safe technique for this indication. We have published several works (2014, 2015) studying whether very low doses of local anesthetics were enough for hip fracture surgery. Our suggestions regarding this topic are frequently used in our surgical rooms. In the meanwhile, studies on ultrasound applied to the trauma patient were performed, i.e. plexus block for upper arm trauma surgery; vascular access; combined approaches (general plus regional anesthesia). A field of interest was safety in the operating room. Several Doctoral Theses were directed and supervised on these topics.

**Conclusion:** Independent investigation in medicine is time consuming and relay in the personal effort of the investigator and its team. At least in Spain, this type of investigation, despite being strictly regulated, is not easy to be carried out and to be maintained along time. However, it is worth the effort.





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## Session VII: Quality Improvement (Education 8)

**Session Director**

Byung Chul Yu (Gachon University, Korea)

**Moderator**

Jung Nam Lee (Gachon University, Korea)  
Seok Ho Choi (Dankook University, Korea)

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Preventable death rate as a quality indicator

Quality indicators in KTDB

Trauma QI - Ideal and reality



## Preventable Death Rate as a Quality Indicator

Gil Jae Lee

Gachon University, Korea

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## Quality Indicators in KTDB

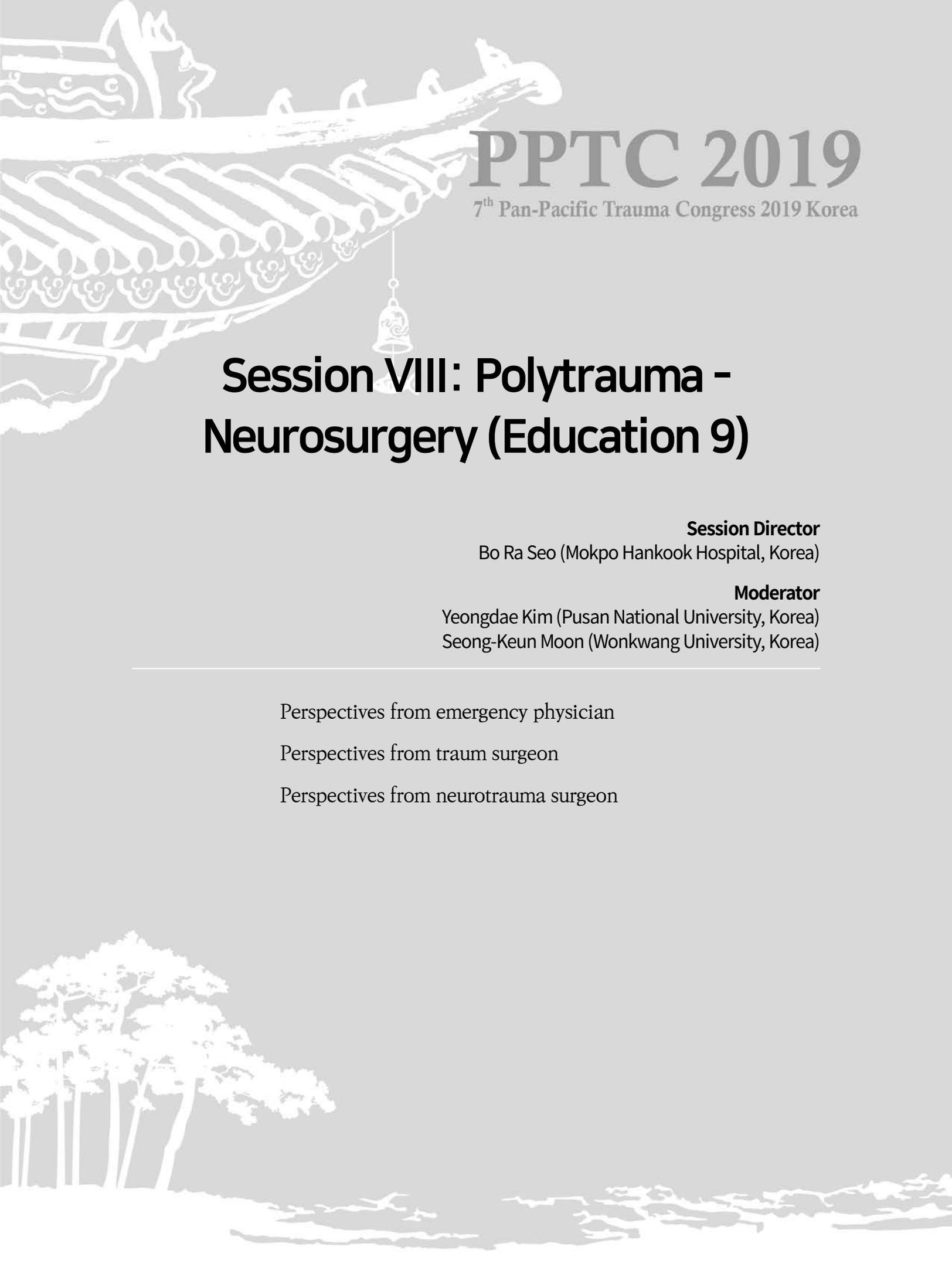
Jong-Min Park

Trauma System Management Team, National Emergency Medical Center, National Medical Center, Korea

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In Korea, injury is the third most common cause of death after cancer and cerebrovascular disease, but it is the major cause of death for the working age population under 40 years old. Also, the preventable trauma death rate in Korea is still higher than in developed countries. This fact has raised awareness of the need to establish a trauma system. For this reason, support services for the establishment of regional level I trauma centers was launched in 2012 by the Ministry of Health and Welfare. The purpose of this service is to designate 17 regional level I trauma centers distributed evenly across the country and to provide adequate care for seriously injured patients 24 hours a day, 7 days a week. Also, the registry of these trauma centers (KTDB) has been progressively established and is actively utilized by accumulating data in trauma quality improvement. As of December 2018, 17 regional level I trauma centers have been selected and 13 of them have officially opened. If the project is completed as planned, the quality of all phases of trauma care (prehospital, transport, and hospital) will be high, and the lives of seriously injured patients can more often be saved and their disabilities minimized.

**Key words:** Wounds and injuries; Registry; Death; Hospitals; Transportation



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session VIII: Polytrauma - Neurosurgery (Education 9)

**Session Director**

Bo Ra Seo (Mokpo Hankook Hospital, Korea)

**Moderator**

Yeongdae Kim (Pusan National University, Korea)

Seong-Keun Moon (Wonkwang University, Korea)

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Perspectives from emergency physician

Perspectives from trauma surgeon

Perspectives from neurotrauma surgeon



# The First Hour of Traumatic Brain Injury: Perspectives from Emergency Physician

류 현 호

전남대학교병원 응급의학과

Airway and Breathing

Circulation

Cervical spine

## (1) Glasgow Coma Scale

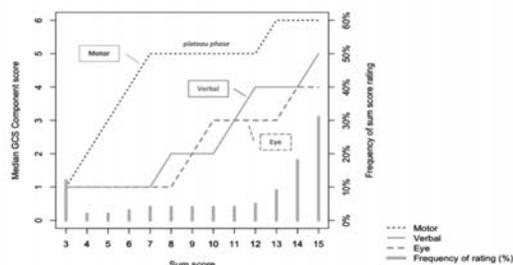
- Developed 1974
  - Low GCS : correlate with poor outcomes
- (1) Requires an interactive patient
  - (2) Other source of blunted neurologic response
  - (3) Airway maneuvers requiring sedatives or paralytics
  - (4) Reliability

Brainz, 2017 Sep 45(9):1902-1943. doi: 10.1016/j.injury.2017.05.039. Epub 2017 Jun 1.

### Differential effects of the Glasgow Coma Scale Score and its Components: An analysis of 54,069 patients with traumatic brain injury.

Beth FCM<sup>1</sup>, Linosma HE<sup>2</sup>, Gaohe B<sup>3</sup>, Lecky FE<sup>4</sup>, Roberts J<sup>5</sup>, Mann AIS<sup>6</sup>

Floor effects of *motor*, *verbal* and *eye* components are reached at sum scores 1, 7 and 8, respectively. Ceiling effects are reached at sum score 13, 15 and 14, respectively. The motor score plateau phase is at sum score 7-12.



### Glasgow Coma Scale is unreliable for the prediction of severe head injury in elderly trauma patients

A Kehoe,<sup>1</sup> S Rennie,<sup>1</sup> J E Smith<sup>1,2</sup>

Older patients with traumatic brain injury present with a higher GCS score than younger patients for a given severity of injury

A Kehoe,<sup>1,2</sup> J E Smith,<sup>1,2,3</sup> O Bouama,<sup>4</sup> A Edwards,<sup>4</sup> D Yates,<sup>4</sup> F Lecky<sup>4,5</sup>

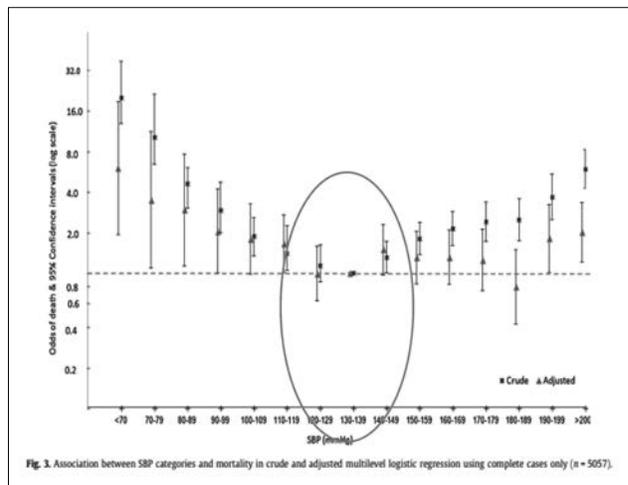
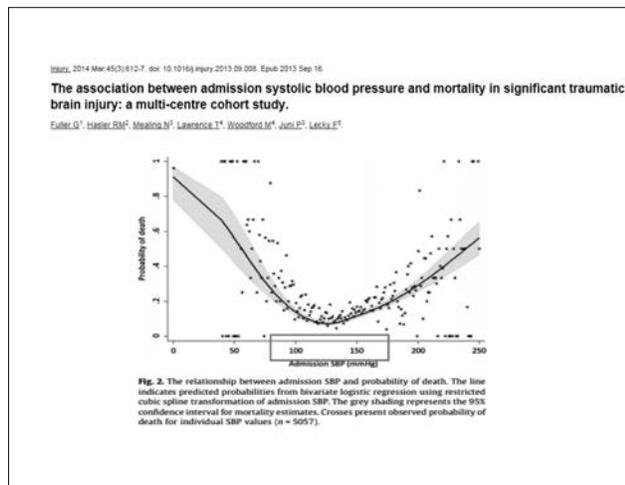
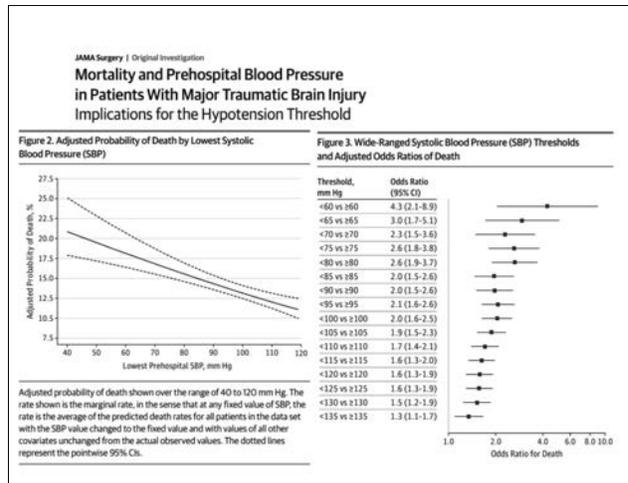
**Table 3** Presenting GCS of patients with isolated traumatic brain injury categorised by age group

	Age		p Value
	<65 years n=244	≥65 years n=317	
<b>GCS</b>			
Overall	14 (9.15)	14 (12.15)	<0.01*
Head AIS 3 only	14 (12.15)	15 (14.15)	<0.01*
Head AIS 4 only	14 (13.15)	14 (14.15)	<0.01*
Head AIS 5 only	13 (7.14)	14 (10.15)	<0.05*
Non-survivors only	4.5 (3.8)	11 (7.15)	<0.01*
Patients undergoing procedure	13 (8.15)	14 (13.15)	<0.001*

Data are presented as median (IQR) or n (%).  
\*From Mann-Whitney U test.  
AIS, abbreviated injury scale.

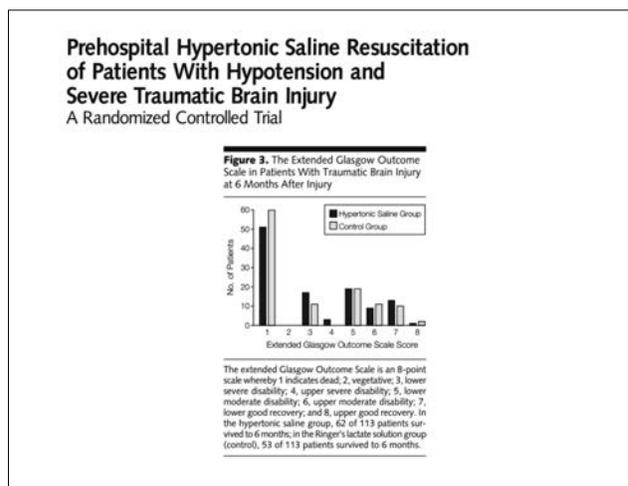
## (2) Blood pressure

- Hypotension : not due to brain injury it-self
- Maintain sBP
  - >100mmHg: age of 50-69
  - >110mmHg: etc
- > ↓ mortality, ↑ outcome



## (3) Fluid Resuscitation

- Hypo-volemia is harmful
  - No to overload
  - Avoid hypotonic fluid
  - Not using glucose-containing fluid
- Ringer's lactate or normal saline is recommended



Review article: Prehospital fluid management in traumatic brain injury

Pek Che Tan,<sup>1,2</sup> Marion Cincotta,<sup>3</sup> Ornella Clavisi,<sup>4</sup> Peter Bragge,<sup>5</sup> Jason Wasiak,<sup>6</sup> Loyal Pattuwaye<sup>7</sup> and Russell L. Green<sup>8</sup>  
<sup>1</sup>Royal Melbourne Hospital, <sup>2</sup>Faculty of Medicine Dentistry and Health Sciences, University of Melbourne, <sup>3</sup>General Practice Liaison, Northern Health, and <sup>4</sup>National Trauma of Research Institute, Alfred Hospital, Monash University, Melbourne, Victoria, Australia

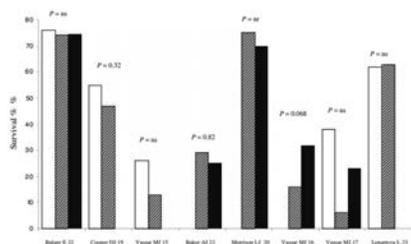


Figure 2. Studies that examined the effect of hypertonic saline (with or without dextrose) compared with normal saline or Hartmann's solution on mortality of patients with traumatic brain injury.<sup>11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100</sup> (□) Hypertonic saline; (■) normal saline/Hartmann's solution; ns, not reported; ns, not significant.

## Perspectives from Traum Surgeon

Dong Hun Kim

Department of Trauma Surgery, Trauma Center, Dankook University Hospital, Cheonan, Korea

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Traumatic brain injury (TBI) remains one of the leading causes of trauma deaths. Improvements are needed in our understanding of the nature and optimal management approaches to TBI. More subtle disruption of cerebral blood vessels, mainly in the microvasculature, or a blood-brain barrier (BBB) breakdown, is common and results in the evolution or progression of hemorrhagic lesions. Management approaches need to focus primarily on hypocoagulopathy with prolonged bleeding, including hemorrhagic progression. Coagulopathy is a common occurrence after severe torso trauma without TBI, and management approaches in these patients include permissive hypotension, hemostatic resuscitation with timely and balanced use of blood-component and fluid therapies, and damage control surgery. However, it is unclear whether the same principles of damage control resuscitation developed for the systemic trauma population might also apply to patients with TBI. The primary goal of treatment for patients with suspected TBI is to prevent secondary brain injury. Because some patients require neurosurgical intervention early, be able to prioritize the treatment of brain injury with other life-threatening injuries such as hemorrhage. Especially, in hemodynamically unstable patients with TBI, manage the discussion between representatives of different surgical specialties to ensure the patient's injuries are treated in the correct sequence.

# Polytrauma with TBI - Perspective from Neurosurgeon -

Bo-Ra Seo

Mokpo Hankook Hospital

## Today's topic

### Prehospital & In-hospital management in Polytrauma with TBI

- Primary Survey : Hypoxia, Hypotension, Hyperventilation
- Resuscitation : Shock management
- Focused neurologic examination

### Priorities for the initial evaluation and triage

- Case illustrations
- ATLS guideline

## Primary survey in trauma patient

### Airway

- 1 Assess the airway and determine its adequacy
- 2 Create or maintain an airway
- 3 Recognize the potential for cervical spine injury and maintain the spine in a safe neutral position.

### Breathing

- 1 Administer high-flow oxygen
- 2 Assess the chest for injuries
- 3 Recognize and treat:
  - a Tension pneumothorax
  - b Massive hemothorax
  - c Flail chest
  - d Sucking chest wounds
  - e Pericardial tamponade

### Circulation

- 1 Assess circulation by:
  - a Looking for external haemorrhage
  - b Observing skin color, temperature, and capillary refill
  - c Feeling the pulse
  - d Recording blood pressure
  - e Assessing neck veins

### Disability

- 1 Assess Glasgow Coma Scale score
- 2 Assess the pupillary size and response
- 3 Examine for lateralizing signs and signs of cord injury

### Exposure

- 1 Expose the patient so that an adequate complete examination can be performed
- 2 Prevent hypothermia.

## Prehospital & Initial In-hospital management in Polytrauma with TBI

### EMS Treatment Really Matters

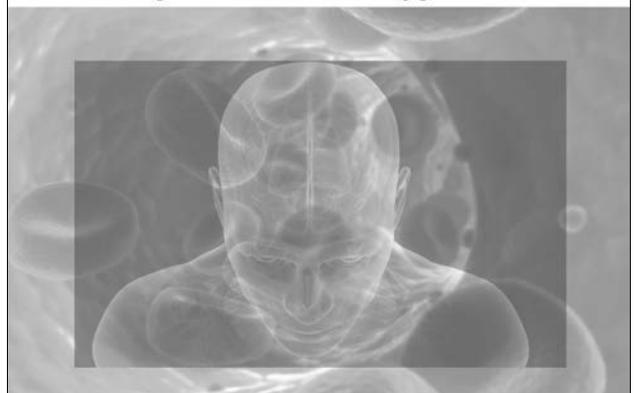
The consequences of:

- Hypoxia
- Hypotension
- Hyperventilation



*are so significant that, if we fail to intervene early... then subsequent "definitive" care will not recover what was lost*

## The Overarching Concept for TBI management is Maintaining Blood Flow and Oxygen to the Brain



### The Science of TBI Hypoxia

- Hypoxia: **O<sub>2</sub> Sat <90** is very common
  - Occurs in >50% of severe TBI patients in the field
  - Occurs in >50% before or during intubation
  - Transient respiratory arrest and hypoxia are common
- Increases morbidity and mortality

O <sub>2</sub> Sat	Severe Disability	Mortality
> 90%	5%	14%
60-90%	27%	27%
< 60%	50%	50%

*Stocchetti, 1996  
Davis, 2003*

### The Science of TBI Hypotension

➤ Hypotension



- A *single* episode of SBP <90 is *independently* associated with *at least* a doubling of mortality
  - Repeated episodes: 8-fold increase

*Manley et al. Arch Surgery 2001*

ORIGINAL ARTICLE

### Hypotension, Hypoxia, and Head Injury

Frequency, Duration, and Consequences

*Geoffrey Manley, MD, PhD; M. Margaret Knudson, MD; Diane Morabito, RN, MPH; Susan Damron, MS, RN; Vanessa Erickson, BA; Lawrence Pitts, MD*

¼ of all severe TBI had a SBP < 90 mmHg

**Background:** Retrospective studies have suggested an association between systemic hypotension and hypoxia and worsened outcome from traumatic brain injury. Little is known, however, about the frequency and duration of these potentially preventable causes of secondary brain injury.

**Hypothesis:** Early episodes of hypoxia and hypotension occurring during initial resuscitation will have a significant impact on outcome following traumatic brain injury.

**Design:** Prospective cohort study.

**Settings:** Urban level I trauma center.

**Patients:** Patients with a traumatic brain injury who had a Glasgow Coma Score of 12 or less within the first 24 hours of admission to the hospital and computed tomographic scan results demonstrating intracranial pathologic features. Patients who died in the emergency department were excluded from the study.

**Main Outcome Measures:** Automated blood pressure and pulse oximetry readings were collected prospectively from the time of arrival through initial resuscitation. The number and duration of hypotensive (systolic

blood pressure, <90 mm Hg) and hypoxic (oxygen saturation, <92%) events were analyzed for their association with mortality and neurological outcome.

**Results:** One hundred seven patients met the enrollment criteria (median Glasgow Coma Score, 7). Overall mortality was 43%. Twenty-six patients (24%) had hypotension while in the emergency department, with an average of 1.5 episodes per patient (mean duration, 9.1 minutes). Of these 26 patients with hypotension, 17 (65%) died (P=.01). When the number of hypotensive episodes increased from 1 to 2 or more, the odds ratio for death increased from 2.1 to 8.1. Forty-one patients (38%) had hypoxia, with an average of 2.1 episodes per patient (mean duration, 8.7 minutes). Of these 41 patients with hypoxia, 18 (44%) died (P=.68).

**Conclusions:** Hypotension, but not hypoxia, occurring in the initial phase of resuscitation is significantly (P<.001) associated with increased mortality following brain injury, even when episodes are relatively short. These prospective data reinforce the need for early continuous monitoring and improved treatment of hypotension in brain-injured patients.

*Arch Surg, 2001;136:1118-1123*

### The Science of TBI Hyperventilation

➤ Hyperventilation

- Hyperventilation is *independently* associated with *at least* a doubling of mortality
  - One study showed a *six-fold* increase in mortality with hyperventilation at *any* time during EMS/early hospital care



**aOR of 5.9 for Death**

### Ground Ambulance

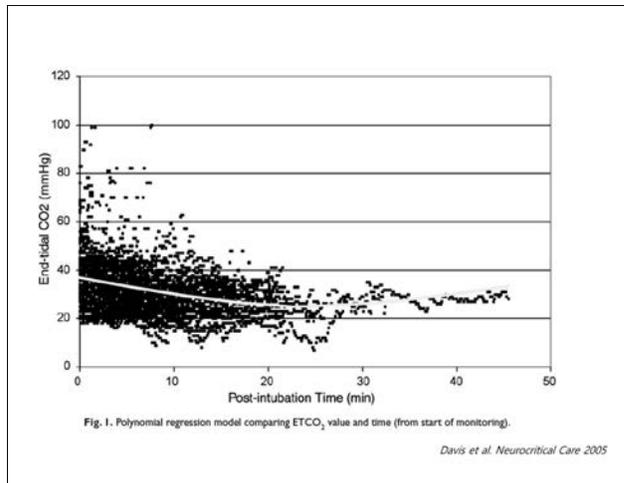
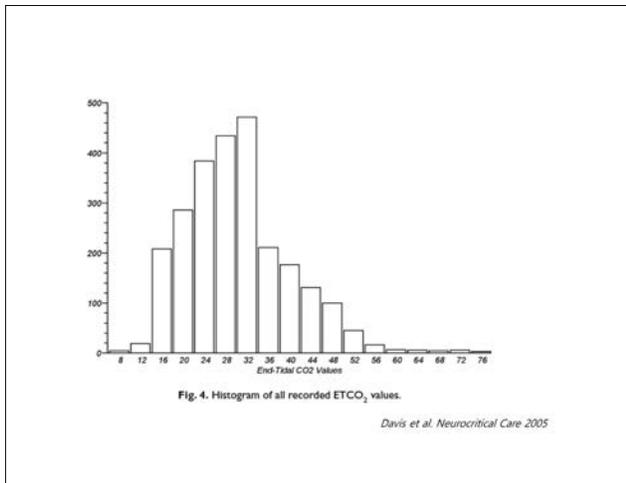
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ISSN 1541-6933/05/2,165-171  
DOI: 10.1385/Neurocrit. Care.2005.2.165-171

**Original Article**

#### Ventilation Patterns in Patients With Severe Traumatic Brain Injury Following Paramedic Rapid Sequence Intubation

*Daniel P. Davis,<sup>1,\*</sup> Robyn Heister,<sup>1</sup> Jennifer C. Paste,<sup>1</sup> David B. Hoyt,<sup>2</sup> Mel Ochs,<sup>1</sup> and James V. Dunford<sup>1</sup>*

<sup>1</sup>Department of Emergency Medicine and <sup>2</sup>Division of Trauma, University of California-San Diego and <sup>3</sup>San Diego County EMS, San Diego, CA

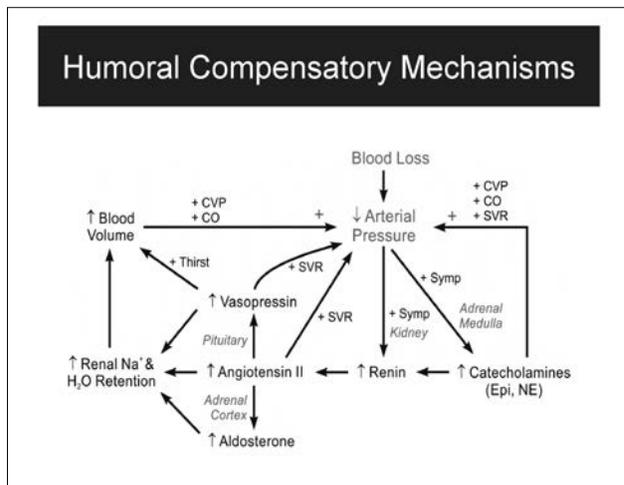


## Resuscitation of Polytrauma

### Hemorrhagic Shock patients

Hypotension usually is not due to the brain injury itself, except in the terminal stages when medullary failure supervenes or there is a concomitant spinal cord injury.

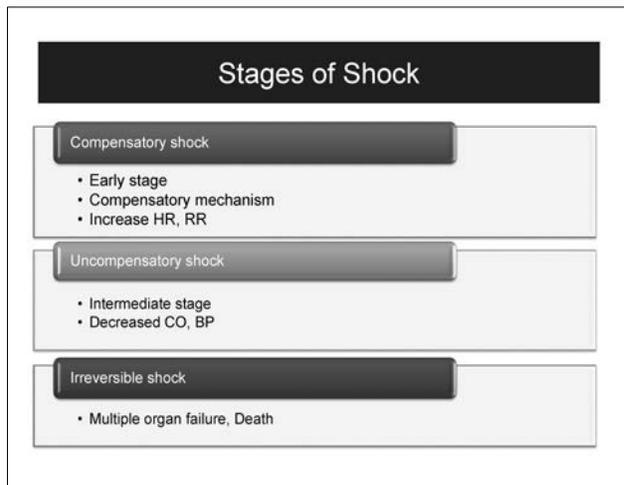
It must be emphasized that the neurologic examination of patients with hypotension is unreliable. The primary source of the hypotension must be urgently sought and treated.



## Classes of Hemorrhagic Shock

PARAMETER	Class			
	I	II	III	IV
Blood loss (%)	0-15	15-30	30-40	>40
Central nervous system	Slightly anxious	Mildly anxious	Anxious or confused	Confused or lethargic
Pulse (beats/min)	<100	>100	>120	>140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal	Decreased	Decreased	Decreased
Respiratory rate	14-20/min	20-30/min	30-40/min	>35/min
Urine (mL/hr)	>30	20-30	5-15	Negligible
Fluid	Crystalloid	Crystalloid	Crystalloid + blood	Crystalloid + blood

\*According to the ATLS course.



### Assessment and Resuscitation

**Assessment**

- A : airway keep and cervical immobilization
- B : breathing support
- C : circulation support
- D : disability
- E : exposure and continue resuscitation

**Resuscitation**

- Venous access : How
- Initial fluid therapy : How or How much

**Evaluation of bleeding focus & Control of bleeding**

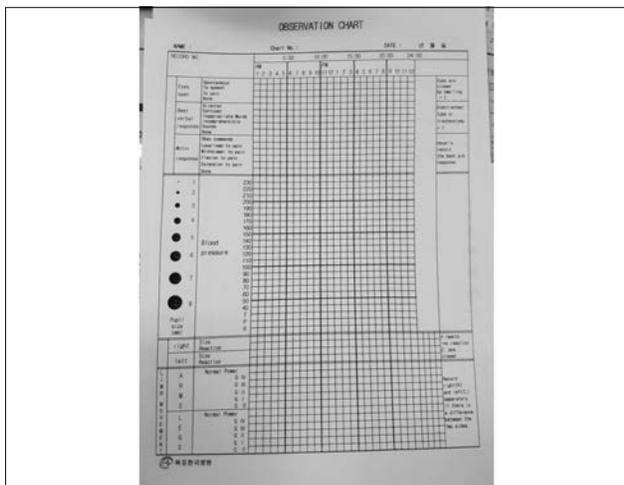
- FAST
- Emergency operation or Endovascular access

### Focused Neurologic Examination

As soon as the patient's cardiopulmonary status is managed, a rapid and directed (focused) neurologic examination is performed. It consists primarily of determining the GCS score, pupil light response, and focal neurologic deficit .

The postictal state after a traumatic seizure will typically worsen the patient's responsiveness for minutes or hours.

It is important to obtain the GCS score and to perform a pupillary examination prior to sedating or paralyzing the patient, because knowledge of the patient's clinical condition is important for determining subsequent treatment.  
 → The shortest-acting paralytic and sedating agents in necessary for safe endotracheal intubation or obtaining good quality diagnostic studies.



### Priorities of the initial evaluation and triage in Polytrauma with TBI

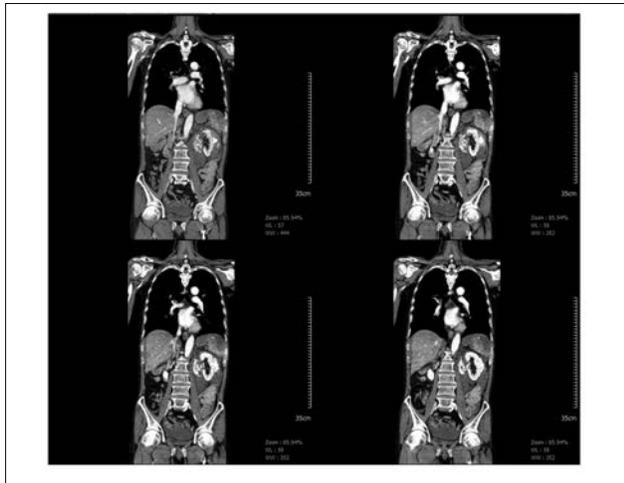
#### Case illustrations

General vital sign vs focal neurologic deficit

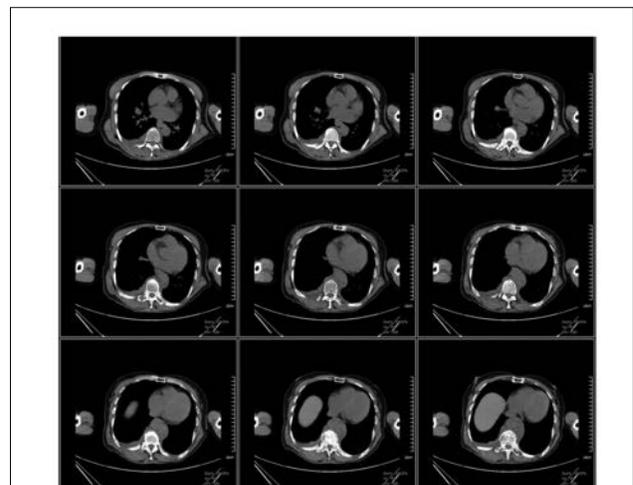
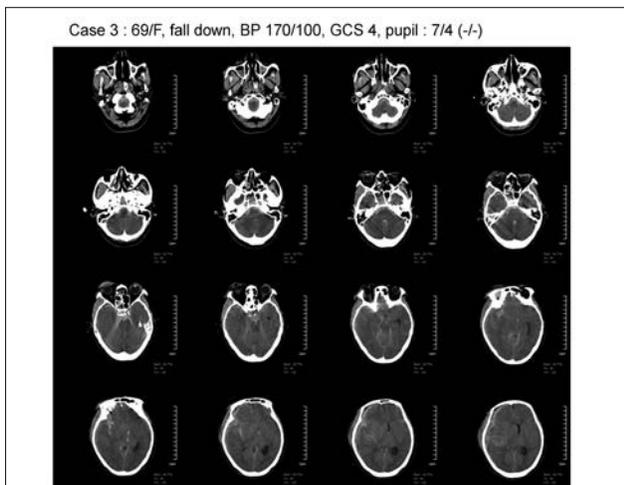
Case 1 : 49/M, hyper-extension injury, Cardiac arrest with ROSC, BP 90/40, no self-respiration, GCS 3

Hypoxic brain damage with high cervical cord damage

Case 2 : 76/M, 차량에서 떨어진 물체에 맞아서 내원, BP : can't check, weak respiration, GCS 3, pupil : 4/8(-/-)



GCS 3 with focal neurologic deficit vs Hypotensive shock  
 → DC vs angiointervention or laparotomy



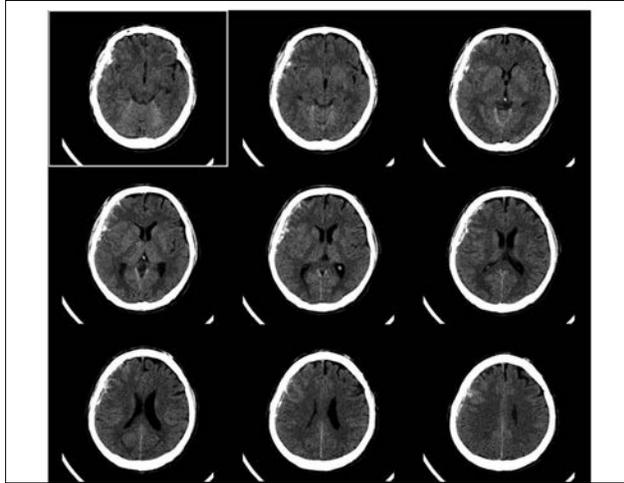
GCS 4 with focal neurologic deficit vs normal vital sign  
 → DC vs thoracotomy

**Timing of Neurointervention with multiple trauma**

47/M, passenger TA on express hi-pass  
 Admission 40 minutes after trauma  
 respiration : weak, initial BP : can't check  
 Emergency transfusion after 20 minutes  
 SBP : 70 mmHg imaging study

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Impression )

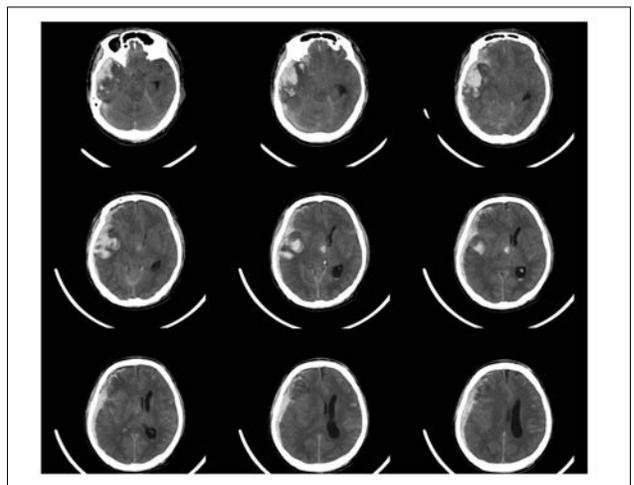
1. ASDH on right F-T-P
2. right hemopneumothorax
3. Hemoperitoneum d/t mesenteric injury with extravasation
4. right scapular fracture

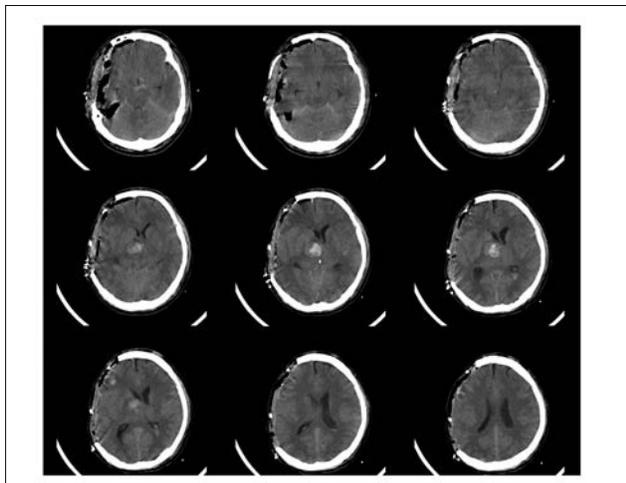
Coma without focal neurologic deficit vs hypovolemic shock

Emergency operation  
 Segmental resection of ileum and side-to-side anastomosis  
 Pre-operative right chest tubing was done

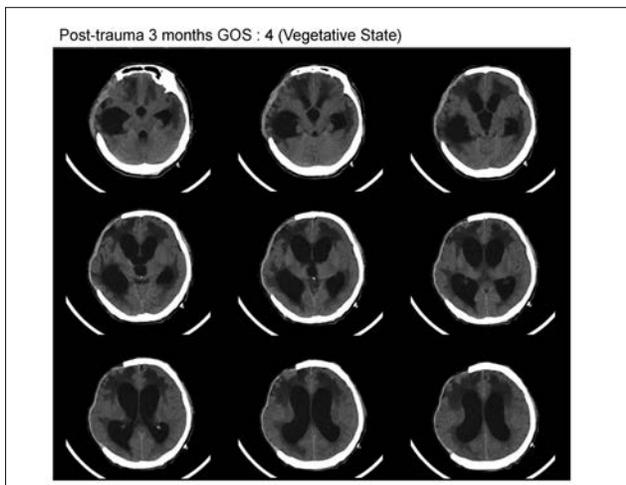
Postoperative N/E : GCS 4 (E1, V1, M2), pupil : iso (4/4) c LR (+/+)

<p><b>After TS operation</b></p> <p>&lt;&lt; CBC &amp; DC &gt;&gt;</p> <table border="1"> <tr><td>RBC count</td><td>(3.59-9.64) : 6.70</td></tr> <tr><td>RBC count</td><td>(14.00-5.50) : 2.38</td></tr> <tr><td>Hemoglobin(Hb)</td><td>(13.2-17.0) : 7.1</td></tr> <tr><td>Hematocrit(Hct)</td><td>(40.4-51.1) : 20.7</td></tr> <tr><td>MCV</td><td>(86.6-102.5) : 87.0</td></tr> <tr><td>MCH</td><td>(28.2-34.4) : 23.8</td></tr> <tr><td>MCHC</td><td>(31.8-34.8) : 34.3</td></tr> <tr><td>Platelet count(PLT)</td><td>(148-338) : 67</td></tr> </table> <p>&lt;&lt; Prothrombin time(Sec X INR) &gt;&gt;</p> <table border="1"> <tr><td>Prothrombin time(Sec)</td><td>(11.5-14.1) : 17.9</td></tr> <tr><td>Prothrombin time(I)</td><td>(95-134) : 54</td></tr> <tr><td>Prothrombin time(INR)</td><td>(0.80-1.00) : 1.55</td></tr> <tr><td>Activated PTT(APTT)</td><td>(29.3-41.9) : 86.6</td></tr> </table>	RBC count	(3.59-9.64) : 6.70	RBC count	(14.00-5.50) : 2.38	Hemoglobin(Hb)	(13.2-17.0) : 7.1	Hematocrit(Hct)	(40.4-51.1) : 20.7	MCV	(86.6-102.5) : 87.0	MCH	(28.2-34.4) : 23.8	MCHC	(31.8-34.8) : 34.3	Platelet count(PLT)	(148-338) : 67	Prothrombin time(Sec)	(11.5-14.1) : 17.9	Prothrombin time(I)	(95-134) : 54	Prothrombin time(INR)	(0.80-1.00) : 1.55	Activated PTT(APTT)	(29.3-41.9) : 86.6	<p><b>8 hours later</b></p> <p>&lt;&lt; CBC &amp; DC &gt;&gt;</p> <table border="1"> <tr><td>RBC count</td><td>(3.59-9.64) : 13.15</td></tr> <tr><td>RBC count</td><td>(14.00-5.50) : 4.11</td></tr> <tr><td>Hemoglobin(Hb)</td><td>(13.2-17.0) : 12.5</td></tr> <tr><td>Hematocrit(Hct)</td><td>(40.4-51.1) : 35.3</td></tr> <tr><td>MCV</td><td>(86.6-102.5) : 86.9</td></tr> <tr><td>MCH</td><td>(28.2-34.4) : 30.4</td></tr> <tr><td>MCHC</td><td>(31.8-34.8) : 35.4</td></tr> <tr><td>Platelet count(PLT)</td><td>(148-338) : 176</td></tr> </table> <p>&lt;&lt; Prothrombin time(Sec X INR) &gt;&gt;</p> <table border="1"> <tr><td>Prothrombin time(Sec)</td><td>(11.5-14.1) : 14.0</td></tr> <tr><td>Prothrombin time(I)</td><td>(95-134) : 83</td></tr> <tr><td>Prothrombin time(INR)</td><td>(0.80-1.00) : 1.12</td></tr> <tr><td>Activated PTT(APTT)</td><td>(29.3-41.9) : 31.1</td></tr> </table>	RBC count	(3.59-9.64) : 13.15	RBC count	(14.00-5.50) : 4.11	Hemoglobin(Hb)	(13.2-17.0) : 12.5	Hematocrit(Hct)	(40.4-51.1) : 35.3	MCV	(86.6-102.5) : 86.9	MCH	(28.2-34.4) : 30.4	MCHC	(31.8-34.8) : 35.4	Platelet count(PLT)	(148-338) : 176	Prothrombin time(Sec)	(11.5-14.1) : 14.0	Prothrombin time(I)	(95-134) : 83	Prothrombin time(INR)	(0.80-1.00) : 1.12	Activated PTT(APTT)	(29.3-41.9) : 31.1
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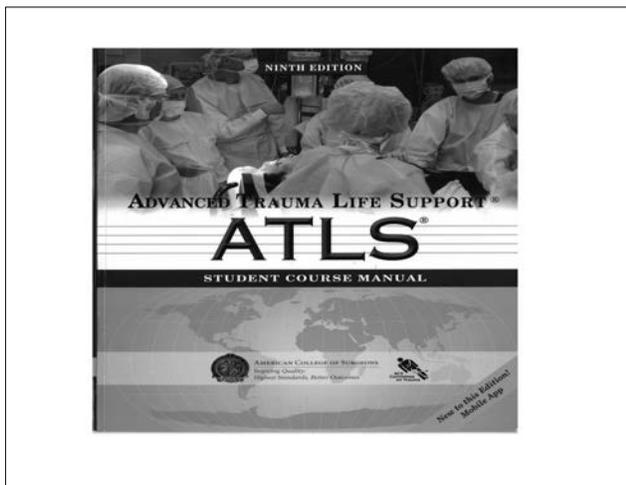


Post-craniectomy #4 days : right diaphragm rupture detect  
exploratory thoracotomy & diaphragm repair  
Other diagnosis  
fracture of right sacral ara, iliac bone, acetabulum & both pubic bone  
fracture of right distal fibula



	Normal vital sign	Hypotensive shock
Focal neurologic deficit (+)	Neurotrauma evaluation	???
Focal neurologic deficit (-)	Secondary survey	Torso-abdomen evaluation

1. Prioritizing diagnostic and therapeutic procedures in the management of multiple trauma patients is a complex task for the trauma teams who must balance the necessity of controlling abdominal or thoracic hemorrhage for hemodynamic stability against the potential risk of delaying craniotomy for repair of treatable lesions at risk of herniation and death.
2. Hemodynamic stability and focal neurologic deficit should be considered in decisions of neurosurgical indication and timing in patients with multiple trauma including head injury



**Box 6-2 Priorities for the Initial Evaluation and Triage of Patients with Severe Brain Injuries**

1. All comatose patients with brain injuries should undergo resuscitation (ABCDEs) on arrival in the ED.
2. As soon as the blood pressure (BP) is normalized, a neurologic exam is performed (GCS score and pupillary reaction). If the BP cannot be normalized, the neurologic examination is still performed, and the hypotension recorded.
3. If the patient's systolic BP cannot be brought up to >100 mm Hg, the priority is to establish the cause of the hypotension, with the neurosurgical evaluation taking second priority. In such cases, the patient undergoes a diagnostic peritoneal lavage (DPL) or ultrasound in the ED and may need to go directly to the operating room (OR) for a laparotomy. CT scans of the head are obtained after the laparotomy. If there is clinical evidence of an intracranial mass, diagnostic burr holes or craniotomy may be undertaken in the OR while the celiotomy is being performed.
4. If the patient's systolic BP is >100 mm Hg after resuscitation and the patient has clinical evidence of a possible intracranial mass (unequal pupils, asymmetric results on motor exam), the first priority is to obtain a CT head scan. A DPL or FAST exam may be performed in the ED, CT area, or OR, but the patient's neurologic evaluation or treatment should not be delayed.
5. In borderline cases—i.e., when the systolic BP can be temporarily corrected but tends to slowly decrease—every effort should be made to get a head CT prior to taking the patient to the OR for a laparotomy or thoracotomy. Such cases call for sound clinical judgment and cooperation between the trauma surgeon and neurosurgeon.

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## Take Home Message

### Primary survey and resuscitation

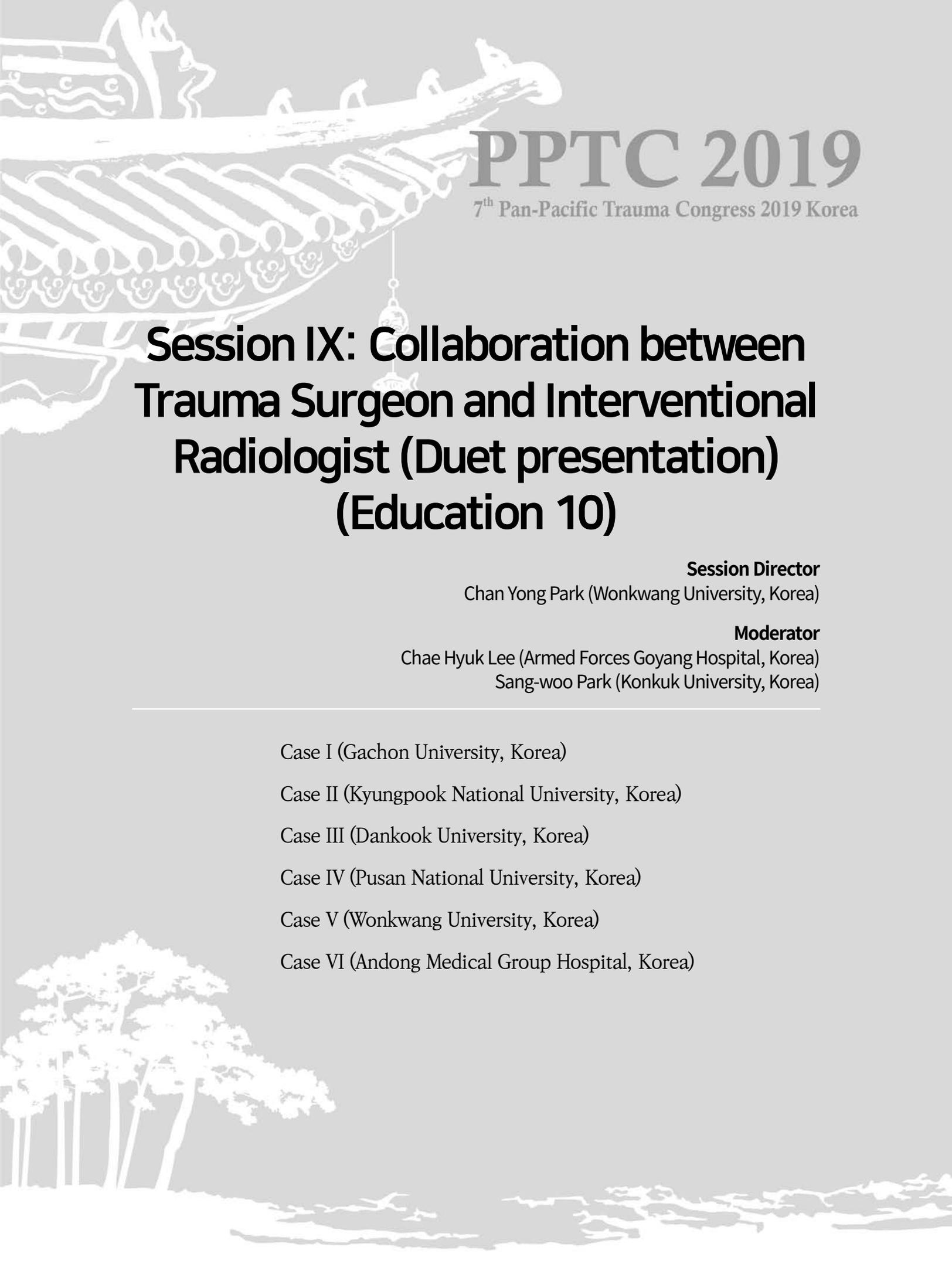
- Cardiopulmonary stabilization
- Early endotracheal intubation in comatose patients
- Avoid hyperventilation
- Focused neurologic examination : GCS, pupil exam, focal neurologic deficit

### Priorities for the evaluation and triage

- Timing of neurologic imaging : hemodynamic stability vs focal neurologic deficit
- Hemodynamic stability should be considered first. (SBP > 100mmHg)
- Trauma is team approach : cooperation between trauma surgeon and neurosurgeon

## Conclusions





# PPTC 2019

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## Session IX: Collaboration between Trauma Surgeon and Interventional Radiologist (Duet presentation) (Education 10)

### Session Director

Chan Yong Park (Wonkwang University, Korea)

### Moderator

Chae Hyuk Lee (Armed Forces Goyang Hospital, Korea)  
Sang-woo Park (Konkuk University, Korea)

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Case I (Gachon University, Korea)

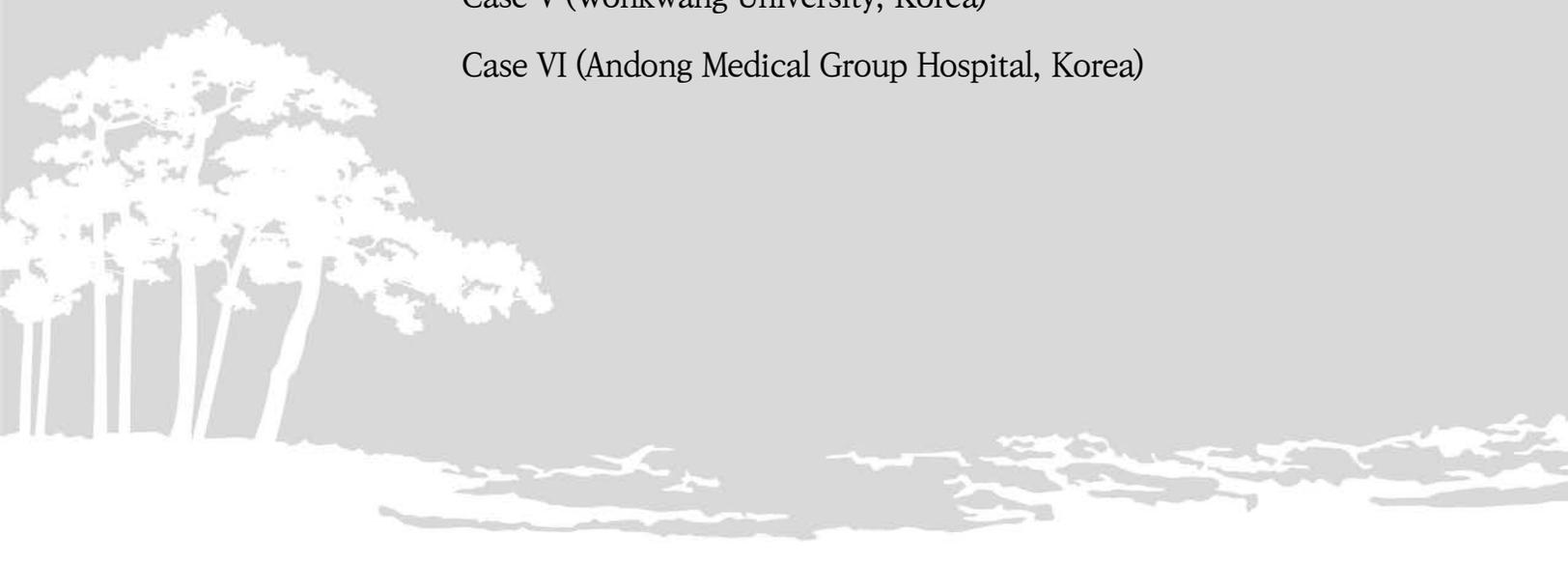
Case II (Kyungpook National University, Korea)

Case III (Dankook University, Korea)

Case IV (Pusan National University, Korea)

Case V (Wonkwang University, Korea)

Case VI (Andong Medical Group Hospital, Korea)





## Case I

Min-A Lee, Jung Han Hwang

Gachon University, Korea

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## Traumatic Mesenteric Pseudoaneurysm: Trans-arterial Embolization and Laparoscopic Exploration

Kyoung Hoon Lim<sup>1</sup>, Sang Yub Lee<sup>2</sup>

<sup>1</sup>Department of Surgery and <sup>2</sup>Department of Radiology, Kyungpook National University Hospital, Daegu, Korea

---

The treatment of mesenteric injuries is necessary to control hemorrhage, and evaluate bowel injury and bowel perfusion. If patient who has mesenteric injuries is stable without evidences of ongoing bleeding and peritonitis, surgeon should decide the exploration or conservation. A 79-year-old woman was injured in a pedestrian accident and transported to our trauma center. On arrival, the patient was hemodynamically stable, and had mild abdominal pain. Abdominal CT with contrast enhancement on previous hospital showed intra-abdominal hemorrhage, huge small intestinal mesenteric hematoma, and a small pseudoaneurysm, but no intra-abdominal free air or changes in the appearance of the bowel wall enhancement. So, we decided her to observe at ICU. Trans-arterial embolization with coils was performed, because Follow-up CT on the next day presented that the size of pseudoaneurysm was enlarged. Angiography showed that pseudoaneurysm was at the distal ileocolic artery. A good perfusion of ileum though right colic artery was confirmed after embolization. On next day after embolization, her physical examination was deteriorated and the serum laboratory findings such as LDH and CPK were elevated. We performed laparoscopic exploration as suspicion of bowel ischemia. Laparoscopic finding showed that ileum with huge mesenteric hematoma was presented moderate ischemic change. Ischemic ileum was improved after evacuation of mesenteric hematoma, and then we could finish an operation without bowel resection. She discharged without complication on tenth day after surgery.

## Collaboration between Trauma Surgeon and Interventional Radiologist

Ye Rim Chang<sup>1</sup>, Min Jeong Choi<sup>2</sup>

<sup>1</sup>Trauma Center, Dankook University Hospital, <sup>2</sup>Department of Radiology, Dankook University Hospital, Cheonan, Korea

---

Herein, we report a case of successful collaboration between trauma surgeon and interventional radiologist. A 29-year-old man sustained blunt trauma from a motorcycle traffic accident. On arrival, he was intubated state with a blood pressure of 124/86 mmHg, pulse rate of 103 beats/min, respiratory rate of 21/min, and hemoglobin level of 8.2 g/dL. After 2 minutes, however, the patient collapsed and blood pressure dropped to 58/32 mmHg.

Outside CT scan revealed severe lung contusion, multiple rib fractures (Rt. 4-12th) with hemopneumothorax, liver contusion (grade II of the AAST injury scale), laceration of the right kidney (grade III), and multiple pelvic bone fracture with active bleeding. Resuscitative endovascular balloon occlusion of the aorta (REBOA) was performed and he was transferred to intervention room immediately after ballooning.

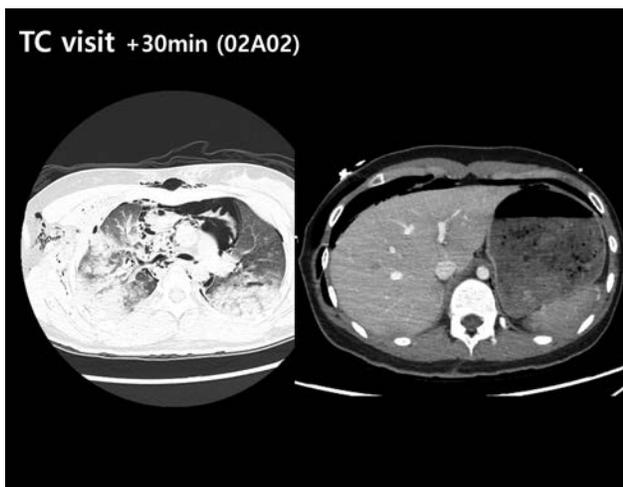
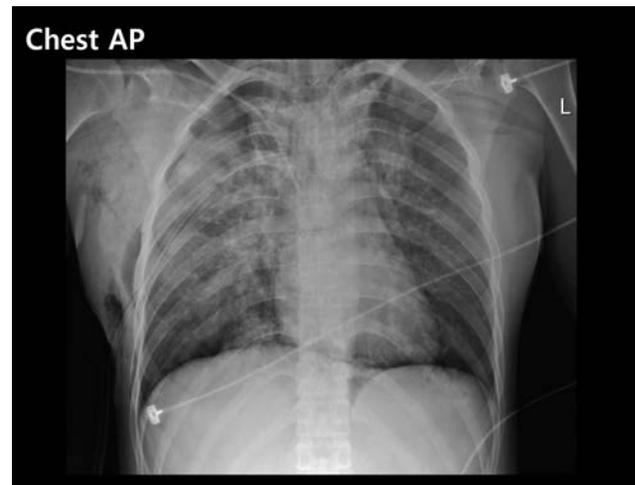
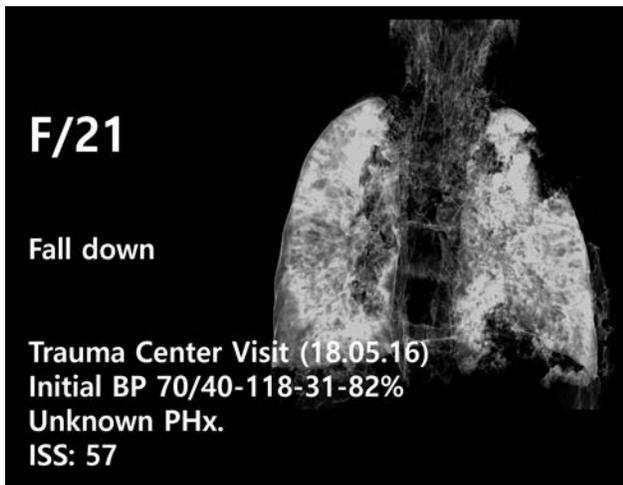
Iliac artery angiography showed irregular aneurysmal dilatation of proximal portion of superior gluteal artery and iliolumbar artery. Superselective embolization using NBCA (33%) and coils was performed. Since renal artery angiography showed arterio-calyceal fistula, superselective embolization was performed.

He was transferred to ICU after embolization. Lung repair, rib fixation, open reduction and internal fixation of the pelvic bones were done on the ICU day 5 and 11, respectively. The patient was discharged 33 days after admission.

## Multidisciplinary Collaboration Pusan National University Hospital

Gil Hwan Kim<sup>1</sup>, Hoon Kwon<sup>2</sup>

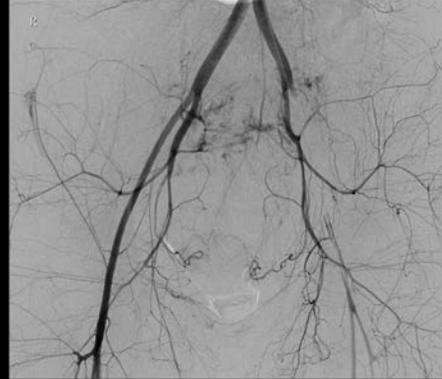
<sup>1</sup>Department of Trauma Surgery, <sup>2</sup>Department of Radiology, Pusan National University Hospital, Korea



Angiography

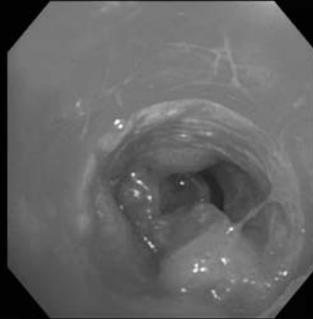


Angiography



Bronchoscopy

Name :



Brochus and Trachea Repair



Brochus and Trachea Repair



POD #98



## Case V

Wu Seong Kang, Seong Nam Moon

Wonkwang University, Korea

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## Case of Emergency Resuscitative Thoracotomy

윤석화<sup>1</sup>, 김영환<sup>2</sup>

<sup>1</sup>국립중앙의료원, <sup>2</sup>안동병원

### Case

▶ M/50 09:10 경 In car TA, 가드레일 수차례 충격

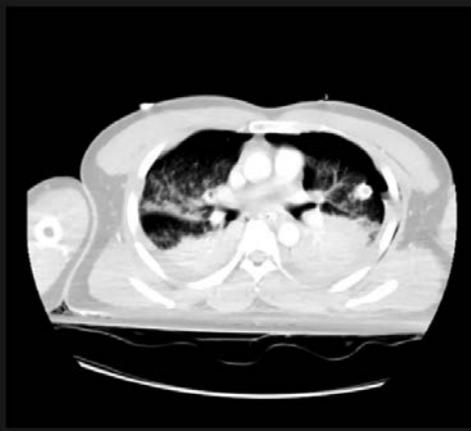
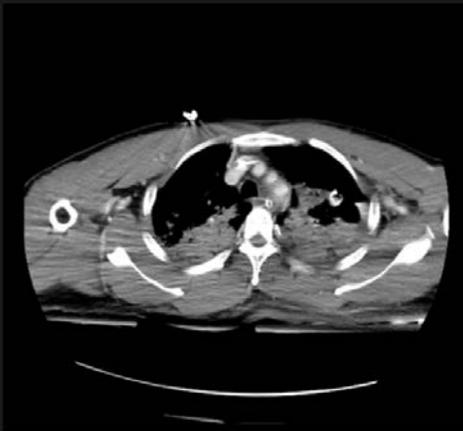
09:50 BP 140/80  
Pupil : 7mm/7mm, (-/-)

10:13 Femoral pulse (-) → CPR

- ▶ Left sided multi-injury of chest
- ▶ FAST (+)

### ER resuscitation room

09:50 소생실 도착, 응급실 Dr. P/E  
10:10 Difficult airway로 Intubation 2~3회 반복  
외상팀 activation  
10:13 Femoral pulse (-) CRP 시작  
10:20 Emergency resuscitative thoracotomy  
→ open cardiac massage  
with thoracic aorta clamping  
10:28 ROSC (+)  
CPR 중 대량 수혈 protocol 발동시켜 수혈  
CT촬영 후 바로 수술실로 들어감



### OP finding

- ▶ Intraabdominal pressure 상승으로 개복과 동시에 복강 내 내용물이 튀어나옴
- ▶ Right adrenal gland rupture 주변 retroperitoneum rupture 로 intraperitoneal bleeding
- Vessel ligation, Gauze packing, temporary abdominal closure

### OP finding (CS)

- ▶ Multiple left rib fracture and sharp bony fragments → trimming with Rongeur
- ▶ Traumatic lung laceration and active air leakage → wedge resection of LUL lingular segment

### OP finding

- ▶ Post op. 7시간 동안 J-P drain bleeding 증가로 re-operation.
- ▶ IVC 주변 small branch 들에서 active bleeding (+)  
→ Tachosil, Greenplast 등 지혈제 사용  
Gauze packing  
Temporary abdominal closure

### Hospital course

- ▶ Post op. SBP 90~110 유지 되나 O2 sat ↓
- ▶ Left chest tube: bloody drain 850cc → angio team call



### Hospital course

- ▶ Post-angiography lab. 상 Hb 9.8 → 13.9
- ▶ BP 점차 호전되어 post-procedure 12시간 후 NE stop, V/S stable
- 이후 jejunostomy, OS op. 시행하며 약 3개월 ICU care → 일반병실 이전 후 약 2개월간 생존

### Emergency resuscitative thoracotomy

- ▶ Emergency resuscitative thoracotomy (ERT)
  - In 1874, Dr. Schiff promoted the concept of ERT
  - Conservative → more aggressive
  - Indication and risks are still debated
  - Outcome is best for penetrating trauma w/ cardiac arrest

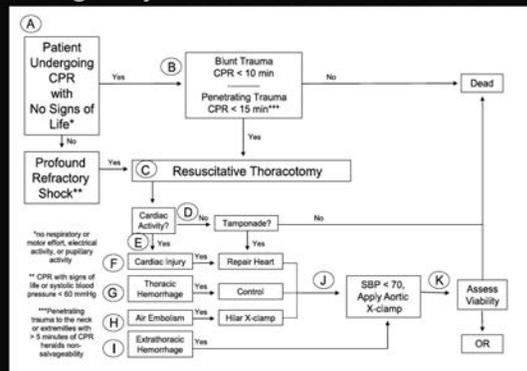
Narvestad JK, et al. Emergency resuscitative thoracotomy performed in European civilian trauma patients with blunt or penetrating injuries: a systematic review. *Eur J Trauma Emerg Surg* 2015; 42(6):677-685

### Emergency resuscitative thoracotomy

- Success of resuscitative thoracotomy
  - : 35% for shock patient with penetrating cardiac wound
  - 15% for all patient with penetrating wound
  - Conversely, relatively poor in blunt trauma patient
  - (2% survival for shock patient, less than 1% for no vital sign)

Burlew, et al. Western Trauma Association Critical Decision in Trauma: Resuscitation thoracotomy. *J Trauma Acute Care Surg* 2015; 73(6):1359-1363

### Emergency resuscitative thoracotomy



Burlew, et al. Western Trauma Association Critical Decision in Trauma: Resuscitation thoracotomy. *J Trauma Acute Care Surg* 2015; 73(6):1359-1363

### Emergency resuscitative thoracotomy

- ▶ Complications of ERT
  - Laceration of heart or lungs
  - Transection of phrenic nerve
  - Aorta clamping failure
  - Transection of inferior mammary artery

Sulbuck JW. Complications of Emergency Center Thoracotomy. *Tex Heart Inst J*. 2012; 39(3):876-877





# PPTC 2019

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## International Session IV: Asian Collaboration on Trauma (II) (Education 11)

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Nam-Ryeol Kim (Korea University, Korea)

Teo Li-Tserng (Tan Tock Seng Hospital, Singapore)

---

Cardiac injury management for general surgeon

Introduction of basic studies on blast injury at National Defense Medical College in Japan

Point-of-care endoscopic optical coherence tomography detects changes in mucosal thickness in ARDS due to smoke inhalation and burns

Improving Trauma Care in Asia





## Cardiac Injury for General Surgeon

Narain Chotirosniramit

Chiang Mai University, Thailand

---

Penetrating cardiac injury is a highly lethal injury. Majority of cases die at scene. Improvement of emergency medical service can decrease the mortality rate at scene. However, the hospital mortality rate is still very high because the lack of competent surgeon such as cardiothoracic (CVT) surgeon to operate the patients. In some situation the CVT surgeon is not available, so general surgeon has to do the surgery to stop the bleeding and relief the cardiac tamponade for saving the patient's life.

The diagnosis of heart injury requires a high index of suspicion. Initially During the primary survey, The patient undergoes focused assessment with sonography for trauma (FAST). Echocardiography is also helpful to evaluate wall motion or valve or septal abnormality in stable patient, but sometimes it is difficult to evaluate the heart due to associated chest wall injury. Pericardiocentesis has been used for diagnosis and treatment of the pericardial tamponade case but now the use of pericardiocentesis has been declined because of the risk of injuries from the needle and low success rate of aspiration due to the blood clot. Subxiphoid pericardial window has been perform both in the ED or the OR with the patient under local anesthesia. This procedure performed in equivocal case of pericardial tamponade.

Treatment of the penetrating cardiac injury must be surgery. There are 2 choices of incision for approach this injury. The first one is median sternotomy which is the incision of choice for the heart operation. It is suitable for the stabilize patient because this incision need more time to reach the heart, but the exposure for every heart chamber is better than the other. The second choice of incision is the left anterolateral thoracotomy which can be use in the extremis case who need immediately bleeding control and take short period of time to reach the heart. The disadvantage of thoracotomy incision is the limitation of exposure and cosmetic. If the surgeon needs to gain more exposure, the surgeon can incise longer incision called "Clamshell incision". This incision extend from left thoracotomy incisions to right anterolateral thoracotomy and cut the sternum transversely. The chest cavity will be opened transversely in half. With this incision extension, surgeon can expose and repair both side of lungs, control the descending thoracic aorta and repair every chamber of the heart.

After opening the chest, pericardium will be incised to relief tamponade. Surgeon should temporarily stop the bleeding from the cardiac wound by many options such as sealing the hole by finger, Occluding the hole by urinary catheter balloon or using of the skin stapler. Then the cardiac wound should be definitively repaired by non-absorbable monofilament suture. For the atrial wound, the suture can be continuously. For the ventricular wound, the suture should be interrupted horizontal mattress suture with the pledget to protect the ventricle wall

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from suture cut through the wall. Before closing the incision, the perimediastinal drain should be placed to prevent postoperative cardiac tamponade from early postoperative bleeding.

## Introduction of Basic Studies on Blast Injury at National Defense Medical College in Japan

Daizoh Saitoh<sup>1</sup>, Yasumasa Sekine<sup>1</sup>, Yuya Yoshimura<sup>1</sup>, Masanori Fujita<sup>1</sup>,  
Yoshiyuki Araki Araki<sup>1</sup>, Yasushi Kobayashi<sup>1</sup>, Hitomi Kusumi<sup>1</sup>, Satomi Yamagishi<sup>1</sup>, Yosuke  
Ohno<sup>2</sup>, Toshiharu Mizukaki<sup>3</sup>

<sup>1</sup>National Defense Medical College, <sup>2</sup>Japan Ground Self Defense Force, <sup>3</sup>Tokai University

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The annual global number of blast injuries is markedly increasing. In particular, primary blast injury induced by shock wave is currently an issue in the world. Prevention and initial therapy for blast injury are emergent and important subjects.

In Japan, we did not have an appropriate model of blast injury, because the ethical restrictions on animal experiments are strict. Several years ago, we established a small animal model of blast injury using a laser-induced shock wave (LISW) as a world first at the National Defense Medical College. Some original articles had already been published in international scientific journals, but these articles were based on using only small animals, e.g., mice and rats. We needed to establish a medium-sized animal model in order to apply the results of studies to human patients. Against this background, we established a blast tube, authorized as a device causing blast injury based on air pressure differences, in 2017, at the National Defense Medical College using the budget for Advanced Research on Military Medicine of Japan. This blast tube is a country-first established in Japan, and it is possible for us to conduct scientific studies on blast injury using medium-sized animals. The blast tube established in our institute has a blast pressure-generating area, control area, and measurement area with the Schlieren instrument and a high-speed camera. The length of the blast tube is 7.5 m, and the outlet window's diameter is 40 cm. The data are automatically recorded in a computer system. In the presentation, we introduce a blast tube established at NDMC, and show some results of a preliminary study using our blast tube.

# Point of Care Diagnosis of ARDS in Smoke Inhalation Injury and Burn Using Endoscopic Optical Coherence Tomography (OCT) Measured Airway Mucosal Thickness

Jae Hyek Choi

The Geneva Foundation, Tacoma WA, USA; United States Army Institute of Surgical Research, JBSA Ft. Sam Houston, TX, USA

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**Background:** The prevalence of acute respiratory distress syndrome (ARDS) in mechanically ventilated burn patients is 33%, with mortality varying from 11-46% depending on ARDS severity. Despite the new Berlin definition for ARDS which led to earlier awareness of ARDS development, prompt bedside diagnosis for ARDS is lacking. We developed and tested a bedside technique of fiberoptic-bronchoscopy-based optical coherence tomography (OCT) measurement of airway mucosal thickness (MT) for diagnosis of ARDS following smoke inhalation injury (SII) and burns. We hypothesized that changes in mucosal thickness (MT) measured by OCT correlate with changes in PaO<sub>2</sub>-to-FiO<sub>2</sub> ratio (PFR) - an index of ARDS.

**Methods:** Female Yorkshire pigs (n=16) received SII and 40% thermal burns, lung protective mechanical ventilation and adjunct treatments such as systemic administration of stem cells (n=6) or low-flow extracorporeal CO<sub>2</sub> removal (ECLS, n=10); and were observed in a round-the-clock animal intensive care unit (ICU) for 72 hours. Measurements of MT, PFR, peak inspiratory pressures and volume of fluids administered were carried out at baseline, post injury (PI), and at 24, 48, and 72 hours after injury. Statistical significance was established at p<0.05; data are represented as mean±SEM.

**Results:** On average, MT in the ARDS group was 77.9±35.8 μm thicker than that observed in animals that did not develop ARDS. Injury led to increase in MT, which was more pronounced in animals that developed ARDS vs those that did not. Particularly in ARDS animals, significant correlations, were found between MT and PFR (ARDS: r=-0.4069, p<0.01, No ARDS: r=-0.2304, p=NS); MT and peak inspiratory pressure (ARDS: r=0.6550, p<0.01, No ARDS: r=0.3134, p=NS), and MT and total infused fluid volume (ARDS: r=0.6113, p<0.01, No ARDS: r=0.4145, p<0.05).

**Conclusions:** OCT is a useful tool to quantify MT changes and development of ARDS following SII and burns. OCT may be effective as a diagnostic tool in the early stages of SII-induced ARDS. The effect of infused volume vs. that of direct airway injury remains to be elucidated.

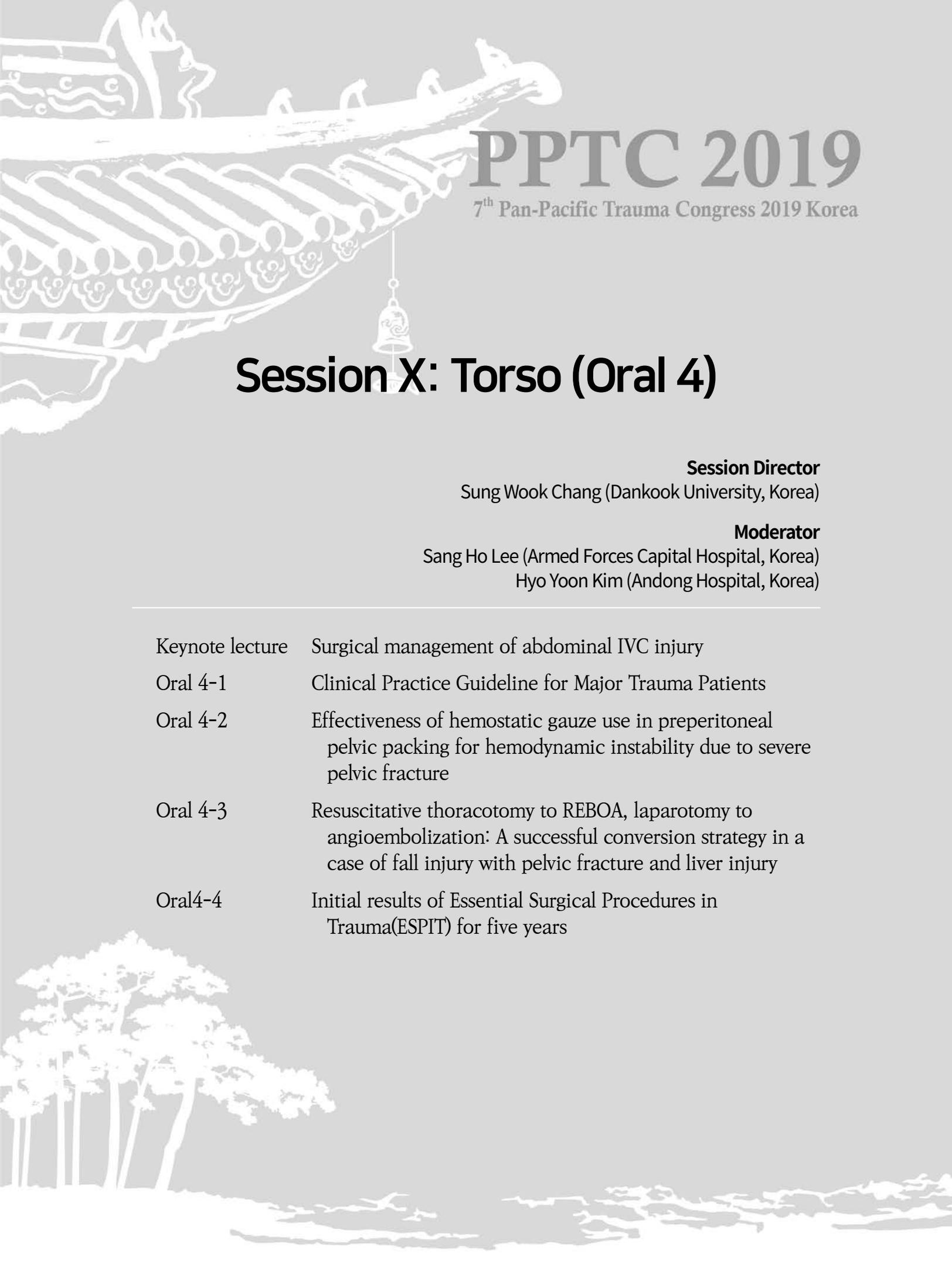
## Improving Trauma Care in Asia

Teo Li-Tserng

Tan Tock Seng Hospital, Singapore

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# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session X: Torso (Oral 4)

### Session Director

Sung Wook Chang (Dankook University, Korea)

### Moderator

Sang Ho Lee (Armed Forces Capital Hospital, Korea)

Hyo Yoon Kim (Andong Hospital, Korea)

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- |                 |  |
|-----------------|--|
| Keynote lecture | Surgical management of abdominal IVC injury  |
| Oral 4-1        | Clinical Practice Guideline for Major Trauma Patients  |
| Oral 4-2        | Effectiveness of hemostatic gauze use in preperitoneal pelvic packing for hemodynamic instability due to severe pelvic fracture                                      |
| Oral 4-3        | Resuscitative thoracotomy to REBOA, laparotomy to angioembolization: A successful conversion strategy in a case of fall injury with pelvic fracture and liver injury |
| Oral4-4         | Initial results of Essential Surgical Procedures in Trauma(ESPIT) for five years   |



# Surgical Management of Abdominal IVC Injury

Dong Hun Kim

Department of Trauma Surgery, Trauma Center, Dankook University Hospital, Cheonan, Korea

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## I. Incidence

- 10 to 15% of cases of abdominal penetration.
- 1 in 50 gunshot wounds.
- Retro-hepatic and intra-pericardial likely to be injured by blunt trauma.
- 50% of patient die before reaching the hospital.
- 20 to 57% mortality in patients who arrive to the hospital with signs of life.

## II. Mechanism

- Blunt trauma caused by shearing forces in violent deceleration affect more often the retro-hepatic and intra-pericardial IVC.
- Most of the injuries are caused by penetrating trauma.
- Almost every patient has injuries to other viscera (liver, duodenum, pancreas, bowel), major vessel (10% of IVC injuries, aorta and portal vein) or both.

## III. Five sections of abdominal IVC

- Suprahepatic
- Retrohepatic
- Infrahepatic
  1. Suprarenal/Subhepatic
  2. Perirenal
  3. Infrarenal ~ bifurcation

## IV. Outcomes

- Half of the patients present with hypotension often with profound hemodynamic instability.
- Most improve with fluid resuscitation. Failure to respond correlates with the presence of active bleeding (fai-

lure of spontaneous tamponade).

- Most of patients with IVC injuries die from exsanguination after exploration of hematoma or free intraperitoneal rupture.
- Survival is associated with spontaneous tamponade or surgically achieved tamponade, especially for retrohepatic IVC injury.

## **V. Principles of Surgical management**

1. Damage control
  - i. Ligation
  - ii. Shunting
  - iii. Packing (for retrohepatic injuries)
2. Vascular control
  - i. Do not approach the bleeding directly
  - ii. Gain proximal & distal control
3. Infrahepatic IVC is likely to be exposed by extended Kocher or Cattell-Braasch maneuver, and repair for that is a lot easier to handle than for retrohepatic IVC.
4. Intra-caval shunt or atrio-caval shunts don't constitute a method of initial hemorrhage control. Bleeding control should be achieved by tamponade before shunt insertion.
5. Three important facts to consider during repair of IVC injuries:
  - i. Patient that didn't die from intra-op hemorrhage or shock tend to be long term survivors regardless of the method of managing the caval injury.
  - ii. Complication of caval repairs or of the expectant management of spontaneously tamponaded caval injuries are very uncommon.
  - iii. The long-term outcome for ligation of the infra-renal IVC is approximately the same as for repair

## Clinical Practice Guideline for Major Trauma Patients

Gil Jae Lee<sup>1</sup>, Kang Hyun Lee<sup>2</sup>

<sup>1</sup>Gachon University College of Medicine, <sup>2</sup>Yonsei University Wonju College of Medicine

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**Objective:** In Korea, the 'Trauma Center Promotion Project' is being carried out in 2012, and there are currently 17 sites designated and operated in some parts of the country. However, there are no standardized guidelines for treatment in each center. Trauma patients need to be treated in specialized trauma treatment and in the special situation where the various departments need to be treated together.

**Methods:** Guidelines were developed by using adaptation methods in order to develop clinical guidelines that become standard in the field of clinical practice. The methodology was composed of a working group to review the composition of the development group, review the guidelines, draw up key questions, write recommendation guidelines for each step, and make a final consultation group.

**Results:** Since the guideline for medical treatment in the field of trauma is the first attempt in Korea, the seven areas corresponding to the initial resuscitation therapy were defined as pilot studies rather than the whole field. 34 key questions were finally confirmed and reviewed. Respectively.

**Conclusion:** Through the methodological procedure, the guidelines for the initial treatment of severe trauma patients were confirmed.

## Effectiveness of Hemostatic Gauze Use in Preperitoneal Pelvic Packing for Hemodynamic Instability Due to Severe Pelvic Fracture

Ji Young Jang, Kwangmin Kim, Hongjin Shim, Pil Young Jung, Seongyup Kim,  
Young Un Choi, Keum Seok Bae

Yonsei University Wonju College of Medicine, Wonju Severance Christian Hospital

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**Objective:** We evaluated the effectiveness of hemostatic gauze use in preperitoneal pelvic packing (PPP) for hemodynamic instability due to severe pelvic fracture.

**Methods:** Between May 2014 and October 2018, among 75 patients with hemodynamic instability due to pelvic fracture, 53 patients who underwent PPP were enrolled in this study. The medical record was prospectively collected and analyzed retrospectively. QuickClot combat gauze (hydrophilic gauze impregnated with kaolin) and general surgical tape were used in 21 patients, and general surgical tape was used in the remaining 32 patients.

**Results:** Because there were significant difference of general characteristics between hemostatic gauze (HG) group and control group, propensity score matching (PSM) was performed to calibrate the age, sex, and worst lactate level. After PSM, clinical characteristics between the two groups were similar. There was no difference in the rate of postoperative wound infection, mortality, and hemorrhage induced mortality between two groups. However, the packed red blood cell (RBC) requirement for additional 12h in the HG group was significantly lower than that in control group ( $4.1 \pm 3.5$  vs  $7.6 \pm 6.1$  unit,  $p=0.0353$ ). The duration of admission to the trauma intensive care unit and the length of hospitalization tended to be shorter in the HG group (11.6 vs 18.5 day,  $p=0.1582$ , 30.8 vs 47.4 days,  $p=0.1861$ ).

**Conclusion:** The use of hemostatic gauze did not increase postoperative infection and had the effect of reducing the amount of additional packed RBC transfusion.

## Resuscitative Thoracotomy to REBOA, Laparotomy to Angioembolization: A Successful Conversion Strategy in a Case of Fall Injury with Pelvic Fracture and Liver Injury

Ryoyu Hayashi<sup>1</sup>, Yosuke Matsumura<sup>2</sup>

<sup>1</sup>Chiba University, <sup>2</sup>Chiba University Graduate School of Medicine

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**Case:** 17 y.o. male, fallen from 11th story, collapsed 5min before the arrival at the hospital and CPR was initiated. His pulse has returned after resuscitative thoracotomy (RT), then we converted to REBOA since X-ray showed no severe chest injury. Pelvic X-ray revealed unstable pelvic ring fractures with sacroiliac joint dissection, and repeated FAST turned positive at right upper quadrant. After temporary closure of the chest and titration as partial REBOA, laparotomy was initiated in the OR. Liver injury was identified but retroperitoneal hematoma was expanding. Perihepatic packing was performed and REBOA was deflated successfully, then vacuum packing closure (VPC) was selected. In the angio suite, internal iliac arteries (IIA) were embolized with gelatin sponge (right) and NBCA (left). Aortography enhanced with Zone3 REBOA showed no signs of visceral extravasation, thus chest was re-closed to control the persistent bleeding shown in the CT. Left chest drainage and VPC continued to bleed despite of correction of coagulopathy. On day2, hepatic artery (A4), right IIA, and medial sacral artery were embolized. The abdomen was definitively closed on day4, extubated on day18, then discharged from ICU on day20.

**Conclusion:** A patient of abdominopelvic injury was resuscitated with immediate RT and early conversion to REBOA. Re-evaluation during laparotomy led to abbreviated surgery and subsequent angioembolization. The aortic occlusion method and its conversion are key of resuscitation but still big challenge, which is chosen according to risk of cardiac arrest, inevitable chest wall bleeding, and feasibility of access.

## Initial Results of Essential Surgical Procedures in Trauma (ESPIT) for Five Years

Pil Young Jung<sup>1,8</sup>, Hohyun Kim<sup>2,8</sup>, Hyun-Min Cho<sup>2,8</sup>, Seog-Ki Lee<sup>3,8</sup>,  
Sung Youl Hyun<sup>4,8</sup>, Chan-Yong Park<sup>5,8</sup>, Oh Sang Kwon<sup>6,8</sup>, Seung-Je Go<sup>7,8</sup>

<sup>1</sup>Wonju Severance Christian Hospital, <sup>2</sup>Pusan National University Hospital, <sup>3</sup>Chosun University Hospital, <sup>4</sup>Gachon University Gil Medical Center, <sup>5</sup>Wonkwang University Hospital, <sup>6</sup>Cheju Halla General Hospital, <sup>7</sup>Chungbuk National University Hospital, <sup>8</sup>Korean Association for Research, Procedure and Education on Trauma (KARPET)

**Objective:** Trauma is main cause of death in South Korea and most common problem for the economically active population. In South Korea, preventable death rate of trauma is gradually decreasing from 50.4% in 1997 through improvement of trauma system. However, trauma education is also an important part of improvement as well as trauma system. The Essential Surgical Procedures in Trauma(ESPIT) course was developed as a model for teaching to trauma concerned doctor by Korean Association for Research, Procedure and Education on Trauma(KARPET).

**Methods:** ESPIT course has been operated from 2014 to 2018, 13 ESPIT totally. The ESPIT course consisted of four lectures and animal lab simulation by porcine for two days. All of ESPIT course providers had to complete a questionnaire to assess self-efficacy difference between pre and post ESPIT course.

**Results:** A total of 187 providers were trained through a total of 13 ESPIT course, all of trainees (100%) received certification. 84(44.9%) of total providers were department of surgery, 31(16.5%) orthopedic surgery, 29(15.5%) thoracic and cardiovascular surgery, 18(9.6%) neurosurgery, 22(11.7%) other doctors such as plastic surgeon, emergency physician, military doctor. 145(77.5%) of all participants were surveyed and overall post-ESPIT mean of self-efficacy score was higher than pre-ESPIT. For educational satisfaction questionnaire, the process evaluation was made with the 10 points Likert scale by providers. Satisfaction with education was high overall. (8.6-9.2)

**Conclusion:** ESPIT course is very useful and effective methods for teaching trauma concerned doctor. In order to continuously develop ESPIT course, it is necessary to have an integrated professional organization and then it is possible to maintain standard education with continuous interest and enthusiasm.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Korea-Japan Symposium II: Trauma Database (Oral 5)

### **Session Director**

Kyung Hag Lee (National Medical Center, Korea)

### **Moderator**

Sung Hyuk Choi (President of KST, Korea)

Daizoh Saito (National Defence Medical College, Japan)

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- Oral 5-1 Improving the performance of trauma center using KTDB
  - Oral 5-2 Overview of Japan Trauma Data Bank (JTDB) and our new findings based on JTDB over 15 years
  - Oral 5-3 Deployment and utilization of database: DKUH trauma center experience
  - Oral 5-4 Establishing clinical evidence from the big data: Challenges by the Japan Trauma Databank investigators



## Improving the Performance of Trauma Center Using KTDB

Byungchul Yu

Gachon University, Korea

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## Overview of Japan Trauma Data Bank (JTDB) over 15 Year

Jun Oda

Department of Emergency and CCM, Tokyo Medical University, Tokyo, Japan

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Japan Trauma Data Bank (JTDB) is a trauma registry system that was established in 2003 by the Japanese Association for the Surgery of Trauma (Trauma Registry Committee) and the Japanese Association for Acute Medicine (Committee for Clinical Care Evaluation) for the purpose of collecting and analyzing trauma patient data in Japan. In 2018, 272 Japanese major hospitals participated in the system.

Our database includes patient characteristics (gender and age), type/mechanism of injury, prehospital information, vital signs on arrival (can calculate RTS), pre-existing disease, results of radiological examinations, transfusion, surgical/non-surgical procedure, surgery, diagnosis, complication, information of admission, and outcome. As for the date and time, injury, ambulance call, arrival on scene, admission to the hospital, CT/angio, end of intensive care, and discharge from hospital are recorded. We select Abbreviated Injury Scale (AIS) codes as diagnosis and injury severity score (ISS) and TRISS/Ps are automatically calculated.

Approximately 350,000 trauma cases have been registered for 15 years, and new findings based on JTDB have been published. However, many challenges still exist in conducting our database. (1) Ethical approval. Since 2016, research ethics regulation has changed, 170 of 272 hospitals participated in this registry system have not accepted ethics committee approval. It became the problem that we can study using only part of the registered data. (2) Securement of the persons for coding. Emergency physicians enter data by themselves in not a few hospitals. Educational courses for AIS coding are held by our committee every year. (3) Too much effort. There are many database such as out of hospital cardio-pulmonary arrest database, sepsis registry, and other medical statistics of emergency medicine. We now try taking some database together, however, auto-registration from electric chart is very hard to achieve despite HL7 compatible in many hospitals.

## Deployment and Utilization of Database: DKUH Trauma Center Experience

Ye Rim Chang

Trauma Center, Dankook University Hospital, Cheonan, Korea

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Trauma database of Dankook University Trauma Center was developed to evaluate and improve trauma care on 2017. The program was fully utilized electronic medical records and the data from KTDB to avoid duplicated data input process.

The categories of DKUH trauma database are as follows:

- Prehospital information: 16 parameters
- Initial manifestation & lab results: 26 parameters
- Initial managements: 13 parameters
- AIS coding: 17 parameters
- Admission-related information: 16 parameters
- Diagnosis, management, operation information: 44 parameters
- Outcomes (complication, mortality, preventable death rate): 10 parameters

Among 142 parameters, 111 parameters were automatically extracted from KTDB and DKUH OCS and 31 parameters were manually recorded according to the chart.

Up to now, data has been collected from January 2015 to December 2018 using this database program. Total 9,693 trauma patients are registered, of which 4,619 (47.7%) cases were Injury Severity Score (ISS)  $\geq$  9. ISS  $\geq$  15 consisted 20.0% (n=1,942). Patients with blunt injury made up for 90.7% of cases and 2,544 (26.2%) patients were admitted in the intensive care unit. Mortality was 5.6 % (n=541) during 4 years in DKUH.

## Advances in Researches over 15 Years Since the Establishment of Japan Trauma Data Bank

Atsushi Shiraishi

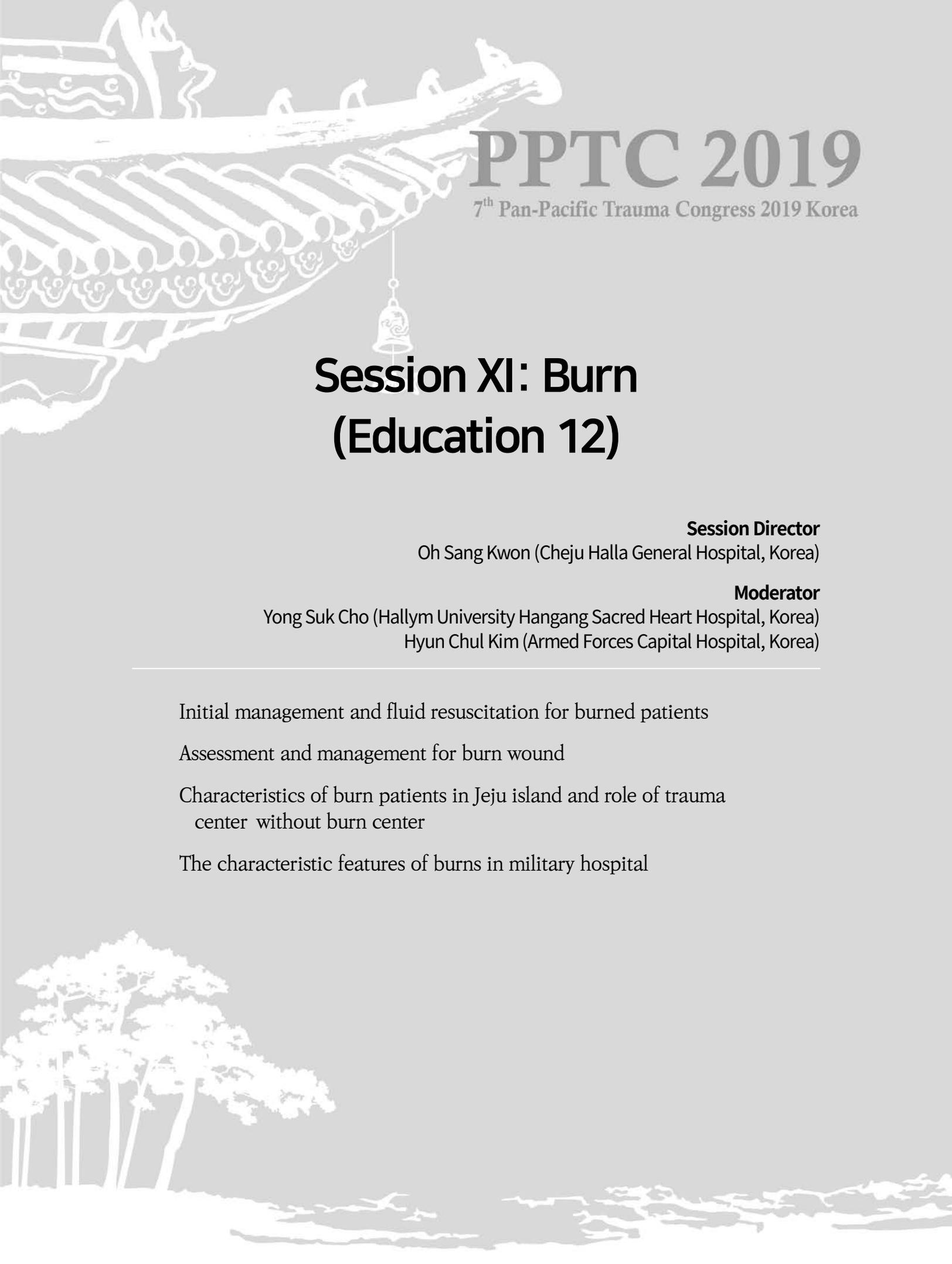
Kameda Medical Center, Japan

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In the current presentation, presenting author demonstrate descriptive statistics of the Japan Trauma Databank (JTDB) and published articles from JTDB.

JTDB was established in 2004, initiated to distribute dataset to the study institute at the year of 2008 and annually updated the dataset thereafter. Volume and quality of JTDB dataset was improving; Number of registered trauma subject in the first dataset (2004 to 2007) was 20,257 subjects from 114 hospitals with 36% missing values and expanded to 294,274 subjects from 277 hospitals with 22% missing values in the latest dataset (2004 to 2017). Researches from JTDB was also expanding. The first peer-reviewed English article using JTDB dataset was published in 2010 (Shoko T et al. J Am Coll Surg 2010). Subsequently, a total of 50 peer-reviewed English articles have been published to date, of which 10 articles were classified in articles of the core clinical journals under definition of PubMed including Journal of American College of Surgeons (3 articles), Journal of Trauma and Acute Care Surgery (5), Medicine (1) and The Bone & Joint Journal (1). Number of published articles using JTDB was increasing over the years; 10 and 40 articles were published in the early years (2010 to 2014) and late years (2015 to 2019) after distribution of JTDB dataset, respectively. Two JTDB studies (Inoue J et al. J Trauma Acute Care Surg 2016, Endo A et al. J Am Coll Surg 2017) coauthored by the current presenter are exemplified as a representative article in order to review the methodology commonly used in JTDB studies, such as propensity score analysis and multi-level regression analysis.

In conclusion, advances in JTDB in terms of institute and patient volume and quality encourage researchers in the participating hospitals and accelerate observational studies based on the questions from various field of trauma.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session XI: Burn (Education 12)

### **Session Director**

Oh Sang Kwon (Cheju Halla General Hospital, Korea)

### **Moderator**

Yong Suk Cho (Hallym University Hwangang Sacred Heart Hospital, Korea)

Hyun Chul Kim (Armed Forces Capital Hospital, Korea)

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Initial management and fluid resuscitation for burned patients

Assessment and management for burn wound

Characteristics of burn patients in Jeju island and role of trauma center without burn center

The characteristic features of burns in military hospital



# Initial Management and Fluid Resuscitation for Burned Patients

Yang Hyeong Tae

Hwachanghan Surgery Clinic, Busan

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## Primary Survey

Immediate evaluation for each burn patient starts with the primary survey, which comprises the following steps.

- Airway management
- Breathing and ventilation
- Circulation and cardiac status
- Disability, neurologic deficit and gross deformity
- Exposure (completely disrobe the patient, examine for associated injuries and maintain a warm environment)

## Airway management

Early intubation is indicated in patients with symptomatic inhalation injury, or any thermal injury to the face, mouth or oropharynx that threatens airway patency

Clinical findings that warrant further evaluation for airway compromise include singed facial hair, carbonaceous sputum, soot in or around the mouth, hoarseness, stridor, increased work of breathing, and inability to tolerate secretions.

Upper airway obstruction occurs in 20–33% of hospitalized thermally injured patients with inhalation injury

## Breathing and Ventilation

The initial responder should auscultate bilateral breath sounds and determine respiratory rate and depth of respiration to evaluate the patient's ability to adequately ventilate and oxygenate, thus assessing the status of the lungs, chest wall and diaphragm.

Specific to burns, identification of circumferential burns of the trunk or neck that may impair respirations is indicated at this time as well, and treatment is the performance of a rapid bedside escharotomy

## **Inhalation Injury**

- Overall mortality rate : 25-50%
- Closed space exposure, facial burns, and carbonaceous debris in the mouth, pharynx or sputum.
- Chest X-rays are routinely normal until complications such as infections have developed.
- Gold standard diagnostic methods - Bronchoscopy
- Pressure control ventilation with permissive hypercapnia is a useful strategy in the management of these patients, and PaCO<sub>2</sub> levels as high as 60 mmHg can be well tolerated

## **Circulation and cardiac status**

Fluid management based on weight and burn size should be addressed once further assessment of burns has been established

Administration of fluid boluses is unnecessary unless hypotension or other signs of hypovolemia are present. Bolus administration leads to further exacerbation of edema formation and should be avoided unless indicated.

## **Circulation and cardiac status**

Compromised perfusion can be secondary to the formation of a tourniquet effect by the non-expandable eschar. Vascular compromise must be identified and treated prior to loss of distal pulses, which is a late finding.

If compromised, escharotomy is indicated. This procedure should be performed by a qualified surgeon to reestablish adequate perfusion.

## **Disability, deficit and deformity**

Patients who have sustained a thermal injury often present without altered mental status.

However, the possibility of associated injury, substance use, hypoxia, inhalation injury or a pre-existing condition should always be addressed as part of the history of the event.

## **Exposure**

The patient must be completely exposed to assess for injury and to remove any contaminants that might prolong contact with chemicals or heat sources.

Thermal injuries can be cooled with cool, not cold, water for approximately 3-5 min.

Ice and cold water should be avoided, as they cause hypothermia, can thus complicate long-term burn management by further conversion of the burn, and may lead to coagulopathy, cardiac arrhythmias and death.

Pediatric patients are particularly susceptible to hypothermia and will need increased active warming efforts.

## **Secondary Survey**

- Assessment of total body surface area burned.

- Assessment of burn depth.

### Assessment of burn area

- 1st degree and erythema should not be included
- Palmar surface: patient's palm is roughly 1% of total body surface area
- Rule of nines: good, quick way of estimating not accurate in children
- Assessment of burn area Lund and Browder chart: most accurate method, age-adjustment

### Referral Criteria

Patients who should be referred to a higher level of care for burns include those with partial thickness (second degree) burns greater than 10% TBSA; those with burns of the face, hands, feet, genitals, perineum, or across major joints; and those with full thickness (third degree) burns of any size.

### Tetanus immunization

The US Centers for Disease Control and Prevention (CDC) have established recommendations for routine vaccination that includes three doses of TT and booster dosing every subsequent decade.

Patients who are current with vaccination status require no further treatment.

Burn patients with unknown or inadequate vaccination status should receive TT in addition to tetanus immune globulin

### Fluid Resuscitation for Burned Patients

Adult patients with burns greater than 20% total burn surface area (TBSA), and pediatric patients with burns greater than 10% TBSA, should be formally resuscitated with salt-containing fluids in the first 24 h following injury; requirements should be based on body weight and percentage burn.

### Resuscitation Formulas

#### Parkland formula

40세 남자환자가 전신에 50% 2도, 3도 화상을 수상하였다. 환자의 키는 170 cm, 몸무게는 70 kg일 때 이 환자에게 첫 24시간 동안 주어야 할 수액량은?

$$\rightarrow 4 \times 70 \times 50 = 14000 \text{ cc}$$

$$3\text{PM} - 11\text{PM} = 7000 \text{ cc (첫 8시간 동안 50\%)}$$

$$11\text{PM} - 7\text{AM} = 3500 \text{ cc}$$

$$7\text{AM} - 3\text{PM} = 3500 \text{ cc}$$

Lactated Ringer's solution without dextrose is the fluid of choice, except in children younger than 2 years, who should receive 5% dextrose Ringer's lactate.

## **Complication of Resuscitation**

Both over- and under-resuscitation are physiologically detrimental to the thermally injured patient.

Over-resuscitation can result in compartment syndrome of the extremities and abdomen as well as acute respiratory distress, while under-resuscitation can further perpetuate burn shock and lead to organ failure.

## **Routes for Resuscitation**

Resuscitation can be given orally or via intravenous fluid. Patients with burns of less than 30% TBSA are candidates for oral resuscitation; however, early oral intake can be used to offset intravenous resuscitation volume requirements for patients with larger burns.

## **Target of Resuscitation**

All the formulas guide resuscitation with the goal of titrating fluids to obtain a urine output of 0.3-0.5 mL/kg/h in adults and 1.0 mL/kg/h in children.

Resuscitation formulas serve merely as a guide and patients are resuscitated based on their physiologic needs, not solely from numbers dictated by a formula.

## **Resuscitation for Pediatric Patients**

Formula instructions further recommend that pediatric patients require more fluid for burns comparable to those of adults due to the increase in body surface area-to-weight ratio.

Maintenance fluids, including a source of glucose, should be added to pediatric patient resuscitation fluid as hepatic glycogen stores will be depleted after 12-14 h of fasting.

## **Escharotomy**

Escharotomy should be performed when circumferential or near circumferential eschar of the extremities compromises the underlying tissues or the circulation distal to it.

Escharotomy should be performed when eschar on the trunk or neck compromises aeration and breathing.

Escharotomy should be performed in the longitudinal axes of the affected part near the neurovascular bundles.

The extent of the incision in the eschar should range from normal skin to normal skin. If this is not possible, the range should extend from joint above to joint below.

The depth of the incision is limited by reaching healthy tissue at the base.

## **Abdominal Escharotomy**

Abdominal escharotomy should be performed when circumferential or near-circumferential eschar is associated with evidence of intra-abdominal hypertension (IAH) or signs of abdominal compartment syndrome (ACS).

## Electrical Burns

- Low-voltage injury (110-220V)
- High-voltage injury (22900V)
- Advocate early exploration of affected muscle beds and debridement of devitalized tissue
- Fasciotomy - release of carpal tunnel
- Urine output > 2mL/kg/hr due to myoglobinuria
- Delayed effect - Neurologic deficit, cataracts
- Lighten Injury - all or none of survival, delayed neurologic deficit

## Fasciotomy

Apart from high-voltage electrical injuries, fasciotomy is rarely indicated as a primary procedure in burns. Fasciotomy is more commonly performed once the diagnosis of compartment syndrome has been confirmed, particularly in cases of very deep burns whatever their etiologies.

## Chemical burn

- Strong acid : pH < 2
- Strong alkali : pH > 11.5
- Alkalis causes more injury than acid
  - Acids 'coagulation necrosis'
  - Alkalis 'liquefaction necrosis'
    - Alkalis penetrate deeper into the tissues
    - Unite with proteins of tissue to form alkaline proteinates, which are soluble and contain OH ions, allowing further reactions deeper into the tissue.

## Management of Chemical Burn

- Speed is essential for the management of chemical burns
- Removal of all contaminated clothing
- Early, copious lavage (>15-20L)
  - Dilute the agent already in contact skin
  - Monitoring of the pH
    - : Quantifiable information as to adequacy of lavage
  - Do Not use neutralizing agents
    - : Because neutralization may liberate a large heat(Exothermic reaction)

## Specific Agents: Hydrofluoric acid

- Commonly used acids in industry

## "Go Together"

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- Glass etching
- Cleaning agent in the petroleum industry
- Extremely painful
- Immediately with copious amounts of 2% calcium gluconate gel
- Intra-arterial injection of Calcium gluconate

### Specific Agents: Hydrofluoric acid

Decrease the level of Calcium and magnesium

Life-threatening Hypocalcemia and Dysarrhythmia

All patients should be admitted for cardiac monitoring, with particular attention paid to prolongation of the QT interval.

As little as 1% TBSA exposure to 50% concentration of HF or 5% TBSA exposure to any concentration is enough to result in potentially fatal hypocalcemia

### References

Total burn care 5<sup>th</sup> Edition

2016 ISBI practice guidelines for burn care

# Assessment and Management for Burn Wound

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## Local Changes

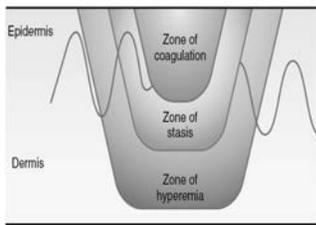


FIGURE 21-1 Zones of injury after a burn. The zone of coagulation is the portion irreversibly injured. The zones of stasis and hyperemia are defined in response to the injury.

## Classification of Burns

BOX 21-2 Burn Classifications	
Thermal	<b>Causes</b>
	Flame—damage from superheated oxidized air
	Scald—damage from contact with hot liquids
Chemicals	Contact—damage from contact with hot or cold solid materials
	Chemicals—contact with noxious chemicals
	Electricity—conduction of electrical current through tissues
Electrical	<b>Depths</b>
	First degree—injury localized to the epidermis
	Superficial second degree—injury to the epidermis and superficial dermis
	Deep second degree—injury through the epidermis and deep into the dermis
Third degree	Third degree—full-thickness injury through the epidermis and dermis into subcutaneous fat
	Fourth degree—injury through the skin and subcutaneous fat into underlying muscle or bone

## Burn Depth

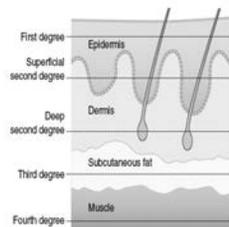


FIGURE 21-2 Depths of a burn. First-degree burns are confined to the epidermis. Second-degree burns extend into the dermis (dermal burns). Third-degree burns are full thickness through the epidermis and dermis. Fourth-degree burns involve injury to underlying tissue structures such as muscle, tendons, and bone.

## Deep 2<sup>nd</sup> degree

- 60C - 3초
- 70C - 1초



## 1st degree burn

- Confined to the epidermis
- Painful, erythematous, and blanch to the touch, with an intact epidermal barrier
- Sunburn or minor scald from a kitchen accident
- No scarring
- NSAIDs

## 2nd degree burn(superficial)

특징)

- 수포(물집) 형성
- 피하조직의 부종
- 수포를 제거하면 정상 바닥 면의 색깔은 분홍 내지 빨간 색을 띠며 윤기가 있고 정상에 흘러나오는 상층액이 많은 것이 특징
- 아주 경미한 접촉에도 매우 민감하며 극심한 통증 유발
- 조직학적으로 보다면 화상으로 인한 손상이 표피층을 지나 진피 유두층(papillary dermis)까지 내려간 것을 표재성 2도화상이라고 분류



치료)

- 표재성 2도화상은 통증 감열이 없는 경우 대부분 10-14일 내에 한돈 없이 완전히 자유됨
- some slight skin discoloration over the long time

Re-epithelialize from rete ridges, hair follicles, and sweat gland

## 2nd degree burn(deep)

특징)

- 수포가 있을 수도 없을 수도 있음
- 정상 바닥 면의 색깔은 분홍색과 하얀 색의 중간으로 보이며, 화상의 통증은 표재성 2도보다는 덜 심하여 부위에 따라 별로 통증이 없는 곳도 있음
- 조직학적으로 피부의 유두층을 지나 진피 망상층(reticular dermis)까지 손상을 경우
- 한돈 형성(hevere scarring)



치료)

- 이 깊이의 화상은 특별한 치료가 필요하다.
- 화상의 상태에 따라, 치료 방법에 따라, 치료 의사의 경험에 따라, 자연 자유될 수도 있고 또는, 피부 이식이 필요한 경우가 생길 수 있다.

## 3rd degree burn

특징)

- 전층 (표피, 진피, 피하 지방층까지) 손상이 생긴 경우
- 피부 조직 및 신경을 포함한 모든 피부 기관들이 손상되어 피부의 본래 기능이 없으며 절대 자연적으로 다시 재생되지 않는 화상일함.
- 따라서 흉부의 통증이 없으며
- 부종도 2도화상에 비해 심하게 나타남
- 괴사된 피부 조직은 하얀 기피(eschar)를 형성하며 흔히 가피 밑으로 조직이 괴사되고 감염되어 농창을 형성하는 수가 많음
- black, white, or cherry red eschar
- 심한 한돈
- 구축 현상(contraction)



치료)

- no epidermal or dermal appendages remain
- heal by reepithelialization from the wound edge 수술
- 가피절제술
- 자가피부이식술

## 4th degree burn

특징)

- 피부 전 층을 포함한 3도화상보다도 더욱 심한 화상
- 고압 전기 화상 환자
- 화상을 입을 당시 목가스, 음주나 약 또는 지병의 약화로 인해 의식을 잃어 계속적으로 불에 타고 있었던 경우
- 피부는 물론 근육, 뼈의 손상, 뇌손상
- 심각한 장애 초래



치료)

- 치료가 어렵다.
- 사지의 절단,
- 조직관여이식술
- 인공피부이식술

## Changes of burn wound (Initial)



HD #3



HD #3



HD #11



HD #16



HD #18 - operation



POD #6



### Assessment of burn area

- 1<sup>st</sup> degree and erythema should not be included
- Palmar surface
  - patient's palm is roughly 0.8%-1% of total body surface area
  - <15% or >85% TBSA
  - inaccurate in medium sized burns

### Burn Size(Rule of Nines)

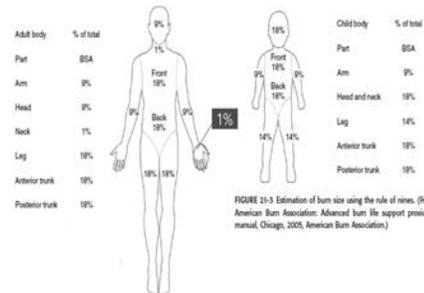
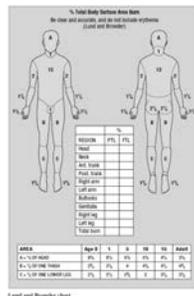


FIGURE 21-3 Estimation of burn size using the rule of nines. (from American Burn Association: Advanced burn life support providers manual, Chicago, 2005, American Burn Association.)

Superficial or first-degree burns should not be included when calculating the percent of TBSA (Total body surface area)

### Assessment of burn area

- Lund and Browder chart
- Most accurate method



### Management

- Prehospital Management
  - : Burning clothing – remove as soon as possible
  - : All rings, watches, jewelry, and belt – a tourniquet-like effects
- Room temperature water can be poured on the wound within 15minutes of injury to decrease the depth of the wound

### Management

- Burn patient should be first considered trauma patient
- Initial evaluation of the burn patient
  - airway management
  - evaluation of other injuries
  - estimation of burn size
  - diagnosis of carbon monoxide and cyanide poisoning

### Airway injury

- Facial burns, singed nasal hairs, carbonaceous sputum, tachypnea
- Upper airway obstruction may develop rapidly, and respiratory status must be continually monitored to assess the need for airway control and ventilatory support.
- Progressive hoarseness(stridor) – sign of impending airway obstruction
- endotracheal intubation should be instituted early, before edema distorts the upper airway anatomy

## Cold Application

- Delays edema formation
- Decrease pain
- Not alter the pathologic process
- Ice or cold water – never be used
- In large burn – systemic hypothermia

## Escharotomies

- When deep second- and third-degree burn wounds encompass the circumference of an extremity, peripheral circulation to the limb can be compromised.
- The entire constricting eschar must be incised longitudinally to relieve the impediment to blood flow completely.
- A constricting truncal eschar can cause a similar phenomenon

## Escharotomies

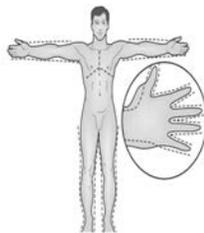


FIGURE 21-9 Recommended escharotomies. In limbs requiring escharotomies, the incisions are made on the medial and lateral sides of the extremity through the eschar. In the case of the hand, incisions are made on the medial and lateral digits and on the dorsum of the hand.

## Escharotomies



Diagram of escharotomies for the chest

## Treatment of the Burn Wound

Table 21-4 Burn Wound Dressings	ADVANTAGES AND DISADVANTAGES
<b>Agarose</b>	
<b>Adhesive dressings</b>	Good against antimicrobial pathogens and easy to use. Does not penetrate eschar, may have fluid barrier. Some dressings will contain an application.
<b>Aluminum acetate (Dakorin)</b>	Good against antimicrobial pathogens, eschar may cause pain to remove also wide application may cause mechanical irritation, mild inhibition of epithelialization.
<b>Biofoam</b>	Ease of application, padding, antimicrobial spectrum not as wide as other agents.
<b>Nonadhesive</b>	Ease of application, padding, antimicrobial spectrum not as wide.
<b>Phenol 5</b>	Ease of application, padding, antimicrobial spectrum not as wide.
<b>Hydrocolloid</b>	Effective in reducing most fungal growth, cannot be used in combination with sulfonamide acetate.
<b>Hydrogel</b>	More effective topical coverage, does not inhibit epithelialization response.
<b>Antimicrobial agents</b>	
<b>Silver sulfadiazine (Silvexin)</b>	Effective against microorganisms, stains contained areas, further reduce from wounds, may cause malodorous odor.
<b>Mafenide acetate (Sulfamylon)</b>	Risk antimicrobial coverage, no fungal coverage, painful on application to remove wound, wide application associated with metabolic alkalosis.
<b>Sulfonamide acetate (Sulfamylon)</b>	Effective against almost all microbes, particularly gram-positive organisms, mild inhibits epithelialization.
<b>Acetic acid (2.0%)</b>	Effective against most organisms, particularly gram-negative ones, mild inhibits epithelialization.
<b>Topical Coverage</b>	
<b>Collin</b>	Prevents a second barrier, imparts antimicrobial activity, use complicated by accumulation of exudate and eschar, requires removal, no antimicrobial properties.
<b>Balsam</b>	Prevents a second barrier, associated with decreased pain, use complicated by accumulation of exudate, mild inhibits wound healing, no antimicrobial properties.
<b>Therapy</b>	Prevents a second barrier, decreased pain, associated wound healing, use complicated by accumulation of exudate, no antimicrobial properties.
<b>Single</b>	Prevents complete second barrier and forms a second eschar, specially made for antimicrobial properties.
<b>Biologic Coverage</b>	
<b>Biograft (Zig-Zag)</b>	Completely covers the wound, provides some immunologic benefits, must be removed or allowed to slough off (Biograft, Culture Skin).
<b>Allograft (Biograft, Culture Skin)</b>	Provides all the normal functions of skin, can have a second eschar, application must be removed or allowed to slough.

## Topical Antimicrobial Agents for Burn Wound Care

- Silver Sulfadiazine (실마진)



- 1.0 % in water-miscible base
- G(-): variable / G(+) – good / Yeast – good
- Exposure or single-layer dressing
- Painless
- Easily applied
- Joint motion unrestricted when exposure method used
- Greater effectiveness against yeast
- Neutropenia and thrombocytopenia
- Hypersensitivity – infrequent
- Limited eschar penetration

### Topical Antimicrobial Agents for Burn Wound Care

• Mafenide Acetate

- 11.1% in water-miscible base
- G(-) : good / G(+) : good / Yeast : poor
- Exposure
- Penetrates eschar
- Joint motion unrestricted
- No gram-negative resistant
- Painful on partial-thickness burns
- Susceptibility to acidosis as a result of carbonic anhydrase inhibition
- Hypersensitivity reactions in 7% of patients



### Wound Care

- Tangential excision
  - deep, dermal, partial-thickness burns
  - a depth of 0.005 to 0.010 inch
  - viable dermal bed is reached
  - clinically by punctuate bleeding from the dermal wound bed
- Full thickness excision
  - a depth of 0.015 to 0.030 inch
  - viable bleeding wound bed, which is usually fat
- Fascial excision
  - large infected wounds, invasive fungal infections
  - subcutaneous fat down to the fascia
  - permanent contour defect, which is impossible to reconstruct
  - lymphatic channels can be excised -> peripheral lymphedema

### Tangential Excision



### Tangential Excision



### Full thickness Excision



### Fascial Excision



### Fasciotomy



### 생물학적 드레싱 (Biologic Dressing)

공범위 창상의 경우 자신의 피부를 이용하여 창상을 다시 복원시키기엔 한계가 있으며 이럴 경우 생물학적 드레싱이 필요하게 된다. 이 드레싱은 종류에 따라 창상 면에 직접 사용 할 수 있으며 대개 자결로 박리 된 창상 면이나 화상 가피 절제술 후에 주로 사용되고 있다.

창상에 존재하는 박테리아의 증식과 성장을 억제 시키고 창상이 건조되어 마르는 것을 방지해 주며 중합되는 수분의 손실을 막고 창상으로부터 발생되는 열 손실을 막아주는 역할을 하게 된다. 또한 창상에서 분비되는 삼출성 단백질과 적혈구의 손실을 막아주며 창상 치유 시 동통을 없애주고 관절운동을 원활히 해주며 조직의 혈관생성도 촉진시키게 된다.

사체피부를 이용한 동종 피부이식(viable cutaneous allograft)은 생물학적 처치의 제일 좋은 방법 중 하나이다.

한가지 생물학적 드레싱은 일시적으로 환자에게 도움을 주는 것이자 자가 피부이식처럼 이식을 통해 영구히 자기피부로 대체 시킬 수는 없는 일시적이며 제한적인 방법이라 하겠다.

### Biological wound covering

Type	Processing	Product
Autologous	Tissue is removed and locally implanted in the same patient Cells are removed via biopsy, cultured and replanted onto the same patient Blood is collected, cells separated, (combined) growth factors are isolated and locally applied in the same patient	Autograft (Mesh, MEEK) Cultured epithelial autograft (CEA)
Allogenic	Acellular dermal collagen matrix Cell and tissue engineered products of the same species Human amnion membrane	AlloDerm® Cultured epithelial allograft (CEH) Amnion
Xenogeneic	Cell and tissue engineered products of different species	Integra® ,Biobrane® Terudermis®, Pelnac®
Combination of autologous, allogenic and xenogeneic types	Protein, cell and tissue engineered products as a combination of autologous, allogenic and xenogeneic types or by genetic recombinant processing	Apligraf® TransCyte® Dermagraft®
Recombinant	Recombinant human platelet-derived growth factor -rhPDGF-BB-	Regranex®

### Biologic Dressing ( Allograft )



### Special Considerations: Electrical and Chemical Burns

- Electrical Burn



## Electrical Burns

- Low-voltage injury(110 – 220V)
- High-voltage injury(22900V)
- The most serious derangement occur during the first 24 hours after injury
- If patient with electrical injuries have no cardiac dysrhythmias on the initial electrocardiogram or recent history of cardiac arrest, no further monitoring is necessary
- Most significant injury – deep tissue Advocate early exploration of affected muscle beds and debridement of devitalized tissue
- Fasciotomy – release of carpal tunnel and Guyon canal
- Urine output > 2mL/kg/hr
- Delayed effect – Neurologic deficit, cataracts

## Chemical burn



## Action mechanisms of chemical agents

<b>1. Reducing agents</b>	Act by binding free electrons in tissue proteins Hydrochloric acid, Nitric acid, Alkyl mercuric agents
<b>2. Oxidizing agents</b>	Oxidized on contact with tissue proteins, the byproducts are continue react with surrounding tissue Sodium hypochlorite (Clorox, Dakin's solution), Chromic acid
<b>3. Corrosive agents</b>	Denature tissue proteins on contact, eschar formation and shallow ulcer Phenols, Cresols, Phosphorus, Lye(강알칼리)
<b>4. Protoplasmic poisons</b>	Binding or inhibiting calcium or other organic ions for necessary for tissue viability and function Acetic acids, Formic acid, Hydrofluoric acid
<b>5. Vesicants</b>	Produce ischemia with aseptic necrosis at site of contact Cantharides(Spanish Fly), DMSO(dimethyl sulfoxide), Mustard gas, Lewisite
<b>6. Desiccants</b>	Damage by dehydrating tissue and are involved in exothermic reactions to release heat into the tissue. Sulfuric acid, Muriatic acid

## Etiology

- Plating process(도금, 판금), Fertilizer manufacture  
→ Strong acids
- Soap manufacture, Use of oven cleaner  
→ Strong alkalis
- Etching process, Petroleum refining, Air conditioner cleaning → Hydrofluoric acid
- Dyes(염료), Fertilizers(비료), Plastics manufacture  
→ Phenol
- Construction workers → Cement

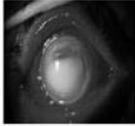
## Alkalis vs Acids

- Strong acid : pH < 2
- Strong alkali : pH > 11.5
- Alkalis causes more injury than acid
  - Acids 'coagulation necrosis'
  - Alkalis 'liquefaction necrosis'
- Alkalis penetrate deeper into the tissues
- Unite with proteins of tissue to form alkaline proteinates, which are soluble and contain OH ions, allowing further reactions deeper into the tissue.

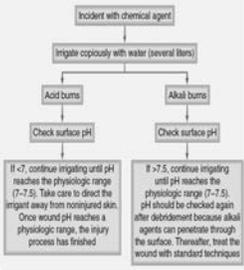
## General Principle of Management

- Speed is essential for the management of chemical burns
- Removal of all contaminated clothing
- Important to protection of healthcare provider
- Early, copious lavage (>15-20L)
- Dilute the agent already in contact skin
- Prevent additional agent from being exposed to the skin  
→ Reduce the extent & depth of full-thickness injury
- Monitoring of the pH
- Quantifiable information as to adequacy of lavage
- Not used to neutralizing agents
- Because neutralization may liberate a large heat(Exothermic reaction)

### Specific Agents

- Sodium hydroxide (가성 소다)
 
- Sodium hypochlorite (Clorox- 표백제)
 

### General Principle



```

    graph TD
      A[Incident with chemical agent] --> B[Irrigate copiously with water several liters]
      B --> C[Acid burns]
      B --> D[Alkali burns]
      C --> E[Check surface pH]
      D --> F[Check surface pH]
      E --> G["If <7, continue irrigating until pH reaches the physiologic range (7-7.5). Take care to direct the irrigant away from noninjured skin. Once wound pH reaches a physiologic range, the injury process has finished."]
      F --> H["If >7.5, continue irrigating until pH reaches the physiologic range (7-7.5). pH should be checked again after debridement because alkali agents can penetrate through the surface. Thereafter, treat the wound with standard techniques."]
    
```

FIGURE 21-19 Algorithm showing treatment of acid and alkali burns.

### Specific Agents

- Acetic acid (빙초산)
 
- Formic acid (개미산)
 

$$\begin{array}{c}
 \text{O} \\
 || \\
 \text{H}-\text{C}-\text{O}-\text{H} \\
 \text{Formic acid} \\
 \text{HCOOH}
 \end{array}$$

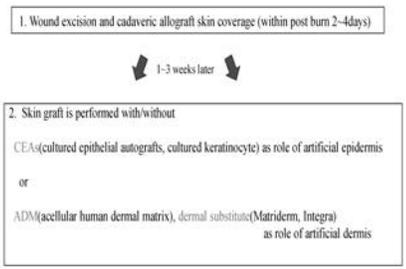
### Specific Agents

- Hydrofluoric acid(HF)
 
- Commonly used acids in industry
  - Glass etching
  - Cleaning agent in the petroleum industry
- Treatment
  - Topical 2.5% calcium gluconate gel
  - 20% calcium gluconate injections
- Serum Ca level & ECG monitor
 

## Hydrofluoric acid(불산)

- Calcium and magnesium
- Life-threatening arrhythmias
- Immediately with copious amounts of 2% calcium gluconate gel
- For example : 3.0g of 2.5% calcium gluconate is mixed with 5 oz of water-soluble lubricant and applied to the wounds five times a day up to four times daily
- Extremely painful
- All patients should be admitted for cardiac monitoring, with particular attention paid to prolongation of the QT interval.
- Speed in treatment of HF is the key to effective treatment

### Flow chart of massive burn treatment



```

    graph TD
      A["1. Wound excision and cadaveric allograft skin coverage (within post burn 2-4days)"] -- "1-3 weeks later" --> B["2. Skin graft is performed with/without CEAs(cultured epithelial autografts, cultured keratinocyte) as role of artificial epidermis or ADM(acellular human dermal matrix), dermal substitute(Matriderm, Integra) as role of artificial dermis"]
    
```

Patient's own skin has always been necessary for wound coverage !!

**Cultured epithelial autografts (CEAs)**

- There are two types of CEAs:
  1. Membrane type (**Holoderm®** by TeGoScience, Korea)
    - has approximately  $1-3 \times 10^7$  of confluent cells in  $56 \text{ cm}^2$ .
    - the several layers of cultured cells are provided on top of petrolatum gauze for easy handling.
    - 8-10 passage
  2. Suspension(spray) type (**Keraheal®** by BioSolution, Korea)
    - has  $3 \times 10^7$  pre-confluent cells in a vial of ice.
    - sprayed on the wounds using the spray device, Tissomat.
    - then, the fibrin sealant is immediately sprayed on the applied suspension cells.
    - 3 passages
- Aim of using CEAs in massive burns
  1. To allow successful wide meshed autograft in massive burns.
  2. To allow concurrent usage of other dermal substitutes for optimal outcomes (1:3-6 meshed autograft with acellular human dermal matrix).

**1. Membrane type of CEAs (cultured epithelial autografts)**



The CEAs were ready after 2-3 weeks of culturing time.  
- Provided on top of petrolatum gauze.



- Wide meshed autograft (1:4-6) and membrane type of CEAs were applied on the wound bed after separating the allograft skin.



1:6 meshed autograft

Covered with CEAs

**2. Suspension type of CEAs (cultured epithelial autografts)**

1. At 4-6 post burn day, cadaveric allograft skin was applied on the excised burn wound and  $1 \text{ cm}^2$  skin biopsy was obtained for keratinocyte culturing



2. At the lab, keratinocytes were isolated from the skin biopsy by magnetic cell isolation methods and then it is cultured using serum free medium under the GMP facility for 14 days.



3. 14 days later after burn wound excision, wide meshed autograft(1:3-6) was applied on the newly formed vessel plexus of wound bed.



4. Suspension type of CEAs was simply inoculated using Tissomat(spray machine) and followed by Fibrin glue(Tissucol) spray.



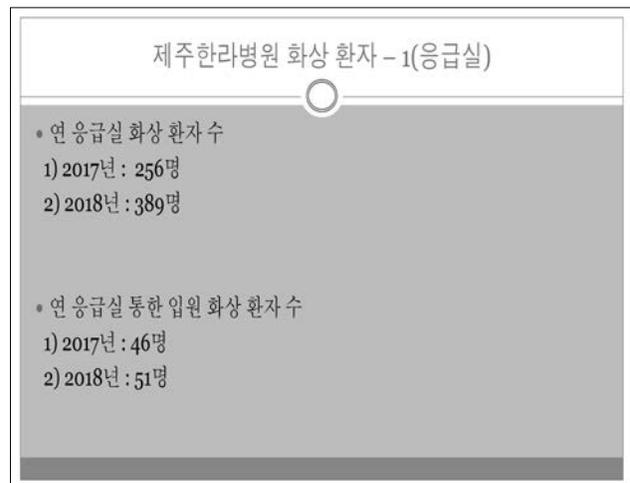
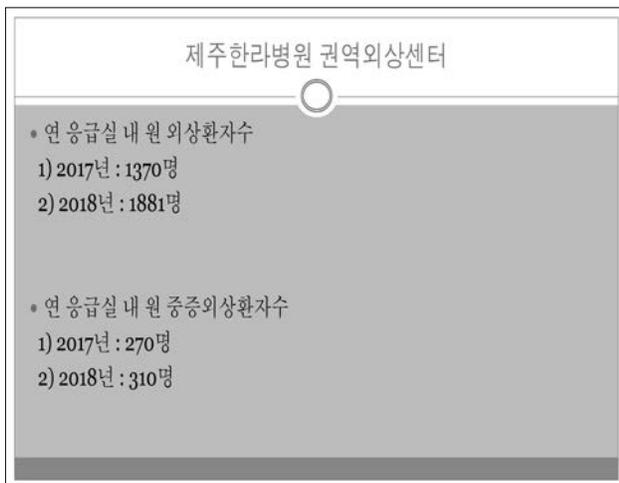
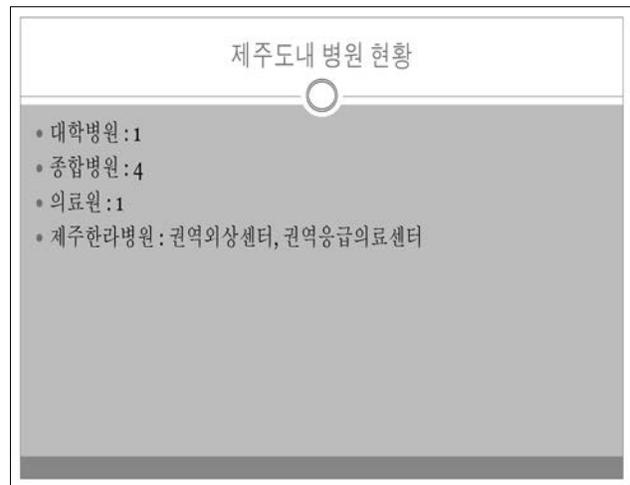
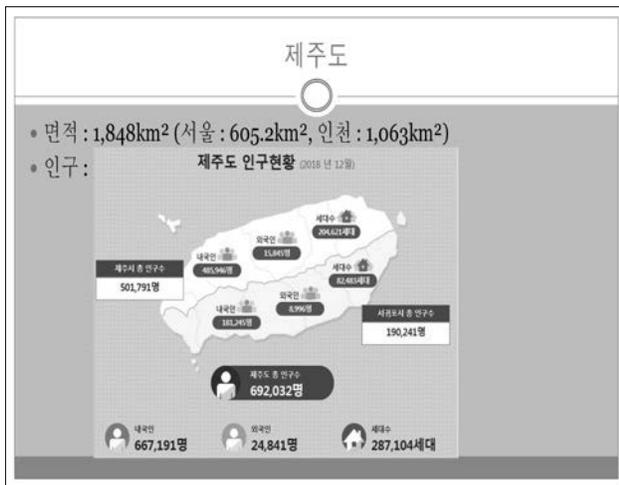
5. Acellular dermal matrix was concurrently used to prevent post scar contractures that may occur on joint areas as well.



# Characteristics of Burn Patients in Jeju Island and Role of Trauma Center without Burn Center

Oh Sang Kwon

Cheju Halla General Hospital, Korea



### 2017년 입원 화상 환자-2(입원-1)

- 총 인원 : 46명
- 내원 경로
  - 1) 직접 내원 : 38명, 2) 외부 전원 : 8명
- 화상 종류
  - 1) 전기 : 8명, 2) 흡입 : 1명, 3) 화학 : 1명
  - 4) 열(열탕 : 16명, 화염 : 14명, 접촉 : 6명)
- ISS
  - 1) <9 : 33명, 9~15 : 8명, >15 : 5명
- 치료 방법
  - 1) ventilator care : 1명, 2) 화상 소독 처치 : 명, 3) 피부이식 :
- 치료 결과
  - 1) 응급실 사망 : 2명, 2) 입원 후 사망 : 2명, 3) 전원 : 5명, 4) 정상퇴원 : 37명

### 2018년 입원 화상 환자-3(입원-2)

- 총인원: 51명
- 내원 경로
  - 1) 직접 내원: 40명, 2) 외부 전원: 11명
- 화상종류
  - 1) 전기: 7명, 2) 흡입: 1명, 3) 화학: 6명(빙초산: 2명, 시멘트: 4명)
  - 4) 열: 37명(열탕: 15명, 화염: 12명, 접촉: 3명, 가스폭발: 7명)
- ISS
  - 1) <9: 39명, 2) 9~15: 8명, 3) >15: 4명
- 치료방법
  - 1) ventilator care: 0명, 2) 화상 소독 처치: 명, 3) 피부이식: 명
- 치료결과
  - 1) 사망: 0명, 2) 전원: 6명, 3) 정상퇴원: 45명

## Special Case-1

ELECTRICAL INJURY

### 46/M

- 패러글라이딩 사고
- 조종사
- 고압전선에 걸림
- 현장 심정지
- 소생술 시행하면서 내원
- 응급실 소생술에 반응 없어 expire 선언

### Figure 1 : 뉴스(구글)에서 캡처 함



### 36/F

- 패러글라이딩 사고
- 관광객
- 고압전선에 걸림
- 심정지(-)
- 좌측 하지의 심한 전기 손상

Figure 2. a)



Figure 2. b)



Figure 2. c)



Figure 2. d)



continue

• 치료

- 1) intubation & ventilator
- 2) central line & hydration
- 3) sedatives & pain killers
- 3) emergency op.(AK amputation & fasciotomy, forearm, Lt.)
- 4) CRRT apply

Figure 3. a)



Figure 3. b)



Figure 3. c)



continue

- 연고지
  - 전문적 화상 치료
  - 향후 reconstruction
- pod#2에 서울 소재 화상센터로 헬기 이송함

### Special Case-2

CHEMICAL BURN(CIMENT)

44/M

- 집 창고 공사
- 시멘트가 장화 속으로 들어 왔는데 작업 지속함
- 3일간 자가 치료하다가 응급실 내원함

Figure 4. a)





### Your Skin on Cement

Irritation, Burns, and Dermatitis

**CAUSE**

Most skin exposure to the highly alkaline, caustic, and irritant properties of cement.

**66%**

of skin cases involving cement have been treated with skin grafts or escharotomies.

**EFFECT**

Concrete can be a subject to:

- Irritation
- Scalding
- Chemical burns

**The HYDROSCOPY PROCESS**

Water in the pores of your skin causes them to swell. This causes the skin to peel away from the body.

1st, 2nd, and 3rd degree burns can form, requiring a skin grafting, such as skin grafts or escharotomies.

4X as many cases are lost to skin problems when compared to other construction trades.

5 in the number of work days missed.

**Treatment**

If cement makes contact with your skin, you can:

- Wash hands
- Change out of wet clothes
- Wash eyes/nose/mouth with clean water
- Apply a Wet Acid Lotion

**Seek Immediate Medical Attention Right Away!**

Multiple periods of prolonged exposure can lead to a long term sensitivity to the chemicals in cement called **Allergic Contact Dermatitis**.

**Prevention**

OSHA recommends that workers who handle cement should wear proper PPE:

- Safety Goggles
- Long Sleeve Shirt
- Long Sleeve Pants
- Chemical Resistant Gloves
- Coveralls or Suits
- Rubber Boots

### Working with cement

Health effects

Cement is one of the most widely used construction materials. When used properly, it can have good health benefits:

- Bone strength
- Stabilization of teeth
- Bone and tissue structure, and ability to heal in the short term, can be treated by working with cement.

Cement burns (scalds) against the skin, or if not washed off, can cause severe skin irritation. Severe burns or blisters can result without any skin irritation. Cement burns can cause:

- Microbiological problems leading to the spread of nearby organisms
- Chemically burning cement dust can cause health problems (respiratory, eye, etc.)

**Burned by cement**

A US worker lost a leg after he suffered fourth degree burns from cement.

He was working on a job when he fell and landed on a bag of cement. He landed on his leg and suffered the injury. He found that the leg had been burned to the bone. He was hospitalized for several weeks. He received extensive treatment at a burn unit. He is now back to work.

**What to do when working with cement**

Anyone using cement, or who is responsible for mixing or spreading it, use, must first consider whether they can control or minimize contact with cement. Otherwise, certain measures should be implemented:

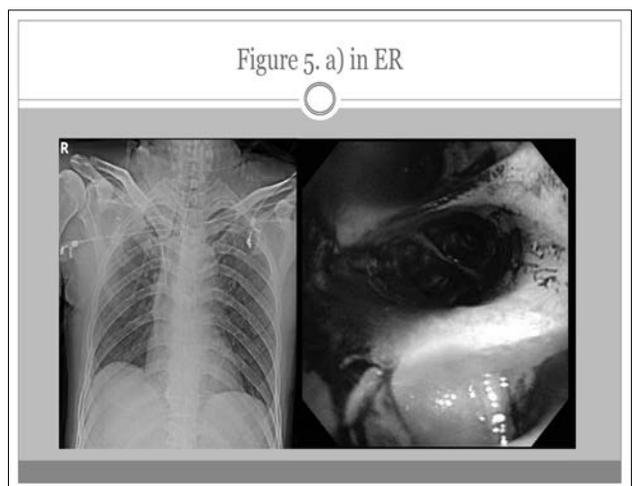
- Wear appropriate personal protective equipment (PPE) such as additional coveralls with long sleeves, chemical resistant gloves, and a respirator and eye protection. Some jobs of working with cement may require that they may not always be suitable for the nature of the work. Check labeling to make sure to use the correct amount of PPE. In general, wear chemical resistant gloves. Some jobs may require:
- Use cement in bulk bags or 50kg bags. When manual handling is unavoidable, the risk should be minimized and workers should wear chemical resistant gloves.
- Keep good hygiene by washing hands and face with soap and water before eating, drinking, smoking or going to the toilet and at the end of the day.
- Single health surveillance in the form of regular skin inspections by a competent person.
- First Aid instructions: remove contaminated clothing then wash contaminated skin with plenty of water. Seek medical attention if symptoms persist. Eye contamination should be washed with clean water for at least 15 minutes before taking the person to hospital.

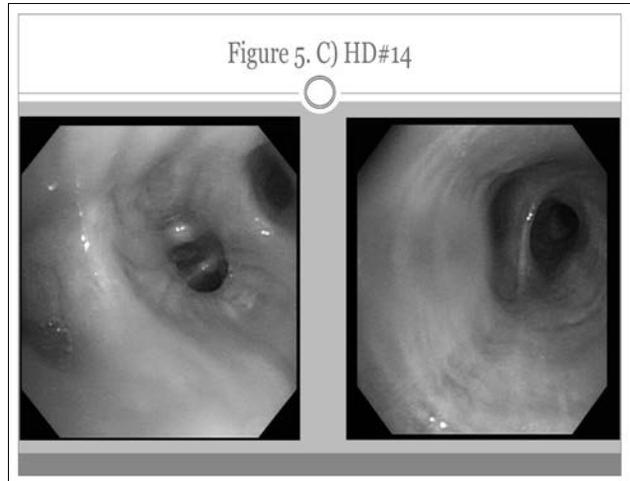
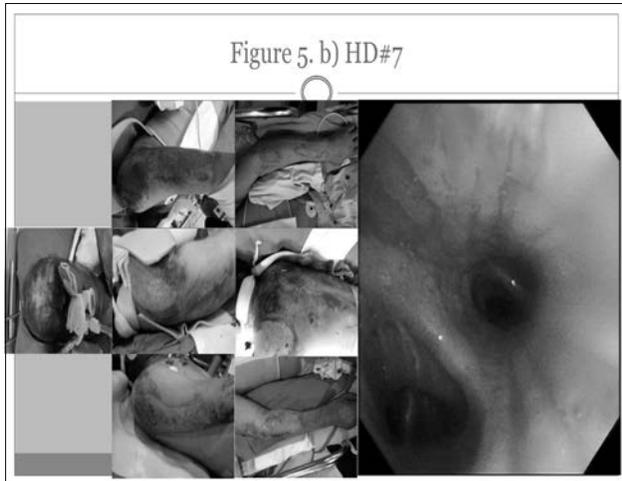
- continue
- 입원
  - Escharectomy & foam dressing
  - Skin graft(partial thickness)
  - Opd f/u

## Special Case-3

### INHALATION BURN

- 76/M
- 집에 화재
  - 본인이 화재 진압
  - 응급실 내원 시 의식 명료, 어깨 통증 호소
  - 응급실 내원 후 1시간 경미한 호흡곤란 호소
  - intubation & ventilator care
  - sedatives
  - bronchoscopic evaluation





### 화상환자에게서 제주권역외상센터의 역할

• 특징

1. 제주도 내 화상센터가 없다.
2. 고립된 섬 지역으로 환자 이송이 어렵다.
  - 1) 항공이송: 헬기, 항공기
  - 2) 선박이송
3. 중증외상환자의 최종 치료기관으로서의 역할

→초기 소생 및 응급 시술에 대한 대비 필요성

→이송 불가능 환자에 대한 치료 대비 필요성

→화상센터로 이송(항공, 선박) 시 환자 안전 대비 필요성

## Characteristic Features of Burns in Military Hospital

Hyun Chul Kim

Department of Surgery, Burn Center, Armed Forces Capital Hospital, Seognam, Korea

**Purpose:** Burns are preventable diseases. We reported the epidemiologic analysis of 908 acute burns(7 years) in the military; J Trauma Inj 2017;30(4), 146-157. We surveyed burn demographics, circumstances of injuries, size, result of treatment. And proposed proper educational programs to suit community. We try to find out the characteristic features of burns in military hospital.

**Methods:** We(Group 1) compared the data of epidemiologic studies of Hanil Hospital(Group 2: 4,321 acute and 1,451 electric burns) and repository of NBR of ABA(Group 3:127,016 records)

**Results:** The Group 1 had more flame burns(FB)(35.8%) than scald(SB)(33.6%). The Group 2 had more SB(57.4%) than FB(30.8%) and Group 3 had more FB(41.8%) than SB(30.1%). Group had prominent contact burns(CB; 24.1%). Though Group 2 had no seasonal differences, burns were more occurred during winter(29.7%) in Group 1. By Group 3 burns had occurred commonly in home(65.5%), by non-work related circumstances(65.0%). By Group 1 they happened mainly in military base as work related accidents.

The results of Group 1: SB had mean 3.9% TBSA of superficial(82.3%) wounds by spillage of hot water/food (61.6%) on lower limbs(45.6%) or feet(33.8%) in summer(34.8%), and treated with simple dressing(92.8%). Morbidity rate was 5.6%, such as PTSD(0.7%). FB had large wound(9.3%TBSA) of superficial(64.3%) burns by ignition to flammable oils(31.7%), bomb powders(29.2%) on head/neck(60.3%), hands(58.6%) in summer(31.7%), autumn(30.2%). They underwent simple dressing(83.4%) and skin graft(16.0%). Morbidity rate was 18.8%; such as PTSD(10.5%), inhalation injuries(4.0%), corneal injury(3.7%), amputations(0.9%), mortality rate(1.2%). CB had small(1.1%TBSA), deep burns(78.5%) by hotpack(80.4%) on lower limbs(80.4%). The more(59.8%) underwent skin graft. EB had 6.8%TBSA, superficial(64.4%) burns by touching to high tension cable(71.1%) on hand(71.1%), upper limbs(24.4%) in autumn(46.8%), They underwent simple dressing(71.1%) and more skin graft(24.4%). They showed particularly high morbidity rate(40.0%); such as loss of consciousness(13.3%), nerve injuries(11.1%), neuropathy(8.9%), amputations(2.2%), mortality rate(2.2%).

**Conclusions:** Keep to the basics can prevent severe injuries and proper education is important. The cook should wear apron over the boots during work. The lighter or smoking should be strictly prohibited during work with flammable liquids or bomb powders. Don't directly apply hotpack to skin for a long time. Use insulating glove during electric work. We expect the burn accidents will be reduced.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session XII: Polytrauma-Orthopedic Surgery (Education 13)

### **Session Director**

Kyung Hag Lee (National Medical Center, Korea)

### **Moderator**

Jong Keon Oh (Korea University, Korea)

Bo Ra Seo (Mokpo Hankook Hospital, Korea)

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Case discussion    Orthopedic injury with neurotrauma-A Polytrauma patients-Multidisciplinary team approach matters





# Orthopedic Injury with Neurotrauma - Polytrauma Patients - Multidisciplinary Team Approach Matters

Jae Woo Cho, Haewon Roh

Trauma Team, Focused Training Center for Trauma , Korea University Guro Hospital

## M/76

- Bicycle Rider without helmet
- Direct hit by Car (PM 12:00)
- Transferred to our hospital (PM 15:55)
- Mental Change

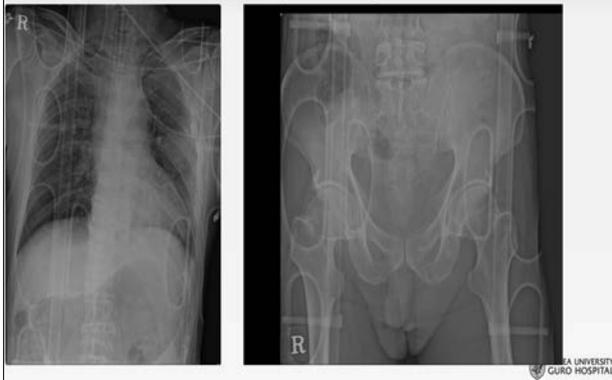


## Pex

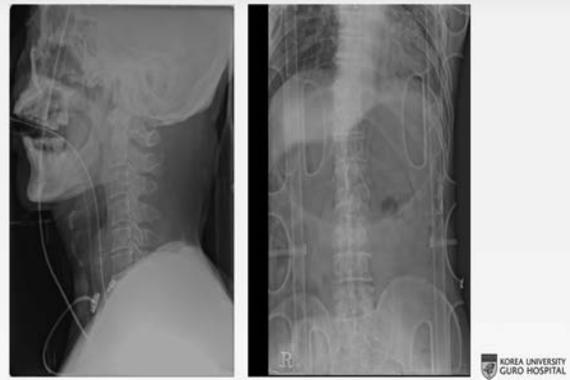
- Ambu bagging status
- Thoracostomy , Lt.
- V/S:60/40-96-14-35.0
- Initial GCS (1/E/1)
- Pupil (5F/3F)
- Extremity-free
- No open wound

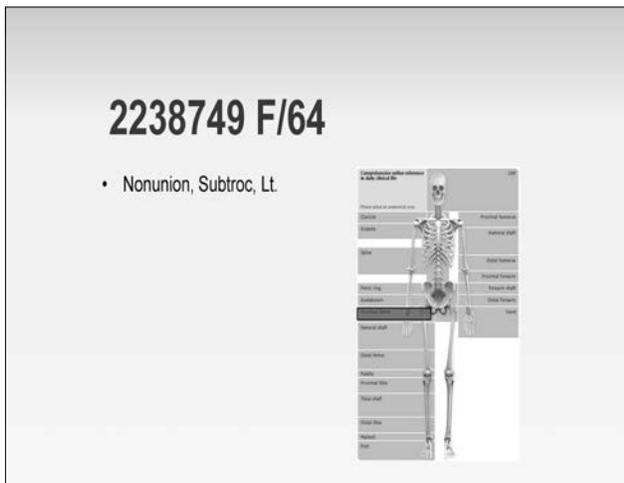
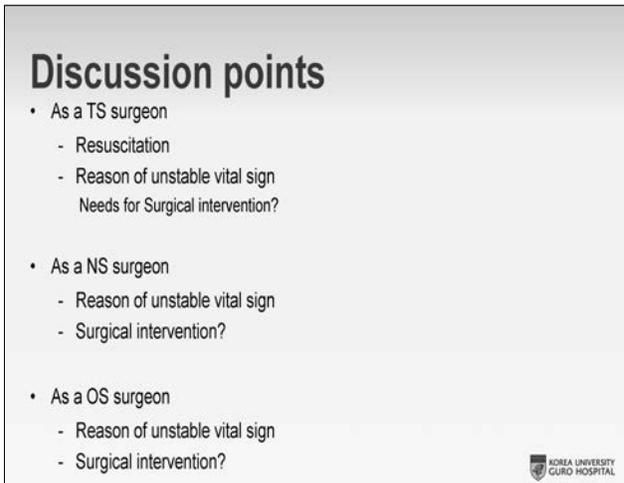
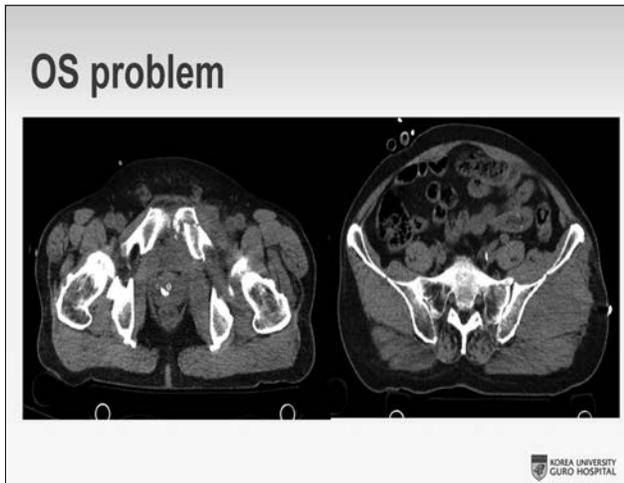
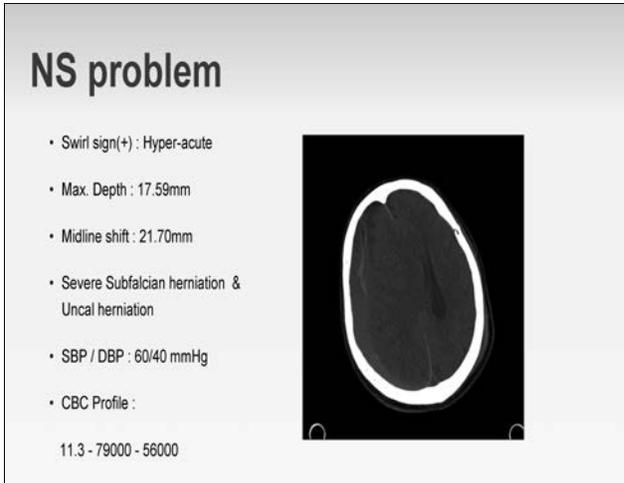
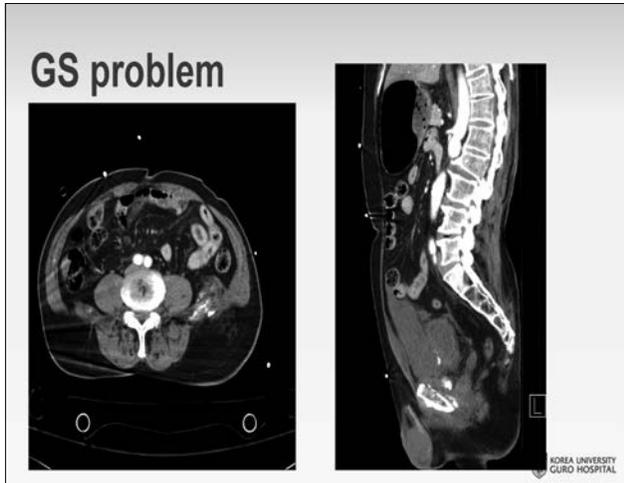


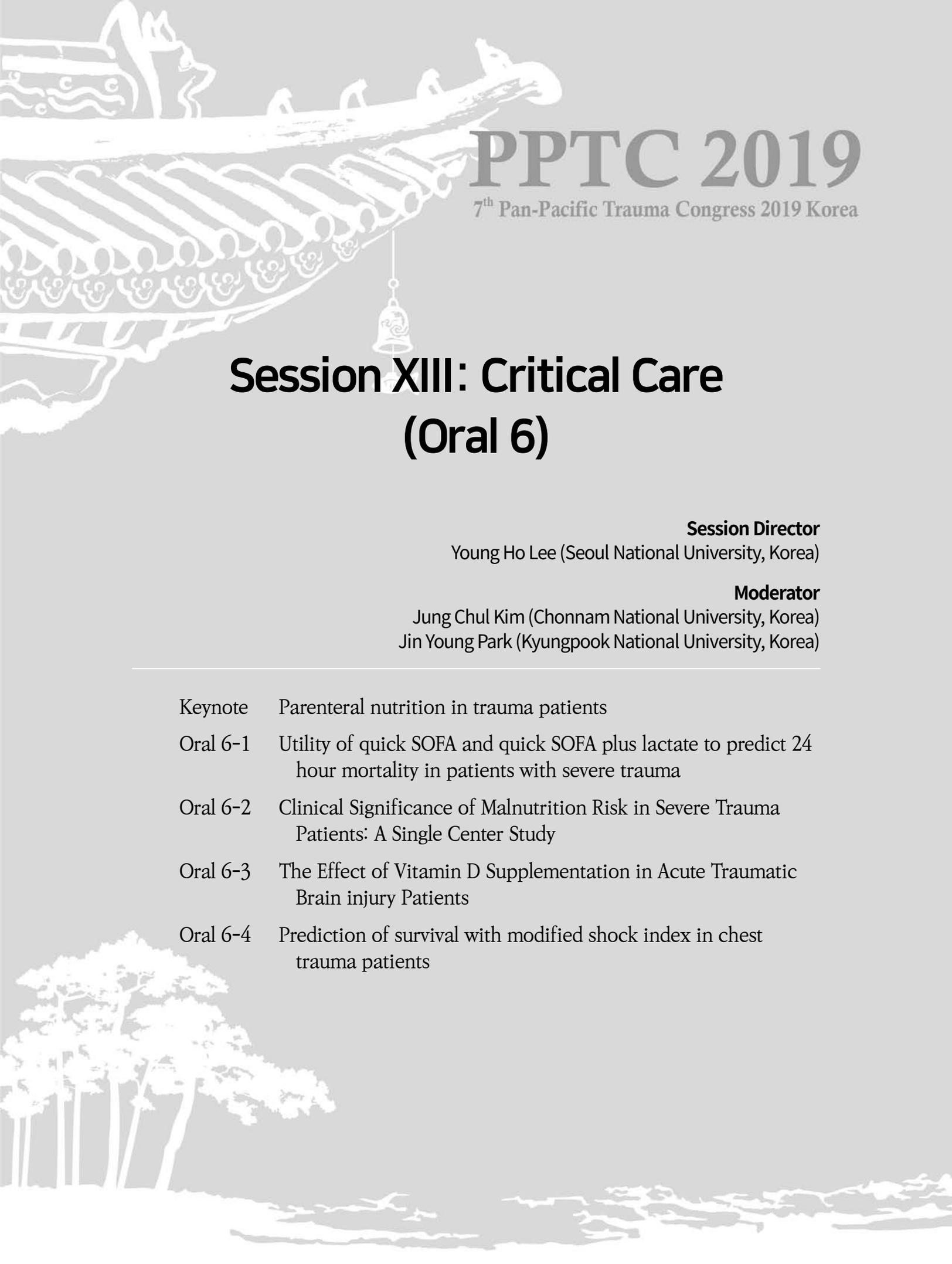
## Trauma series (initial)



## Trauma series







# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session XIII: Critical Care (Oral 6)

### Session Director

Young Ho Lee (Seoul National University, Korea)

### Moderator

Jung Chul Kim (Chonnam National University, Korea)  
Jin Young Park (Kyungpook National University, Korea)

- 
- |          |   |
|----------|---|
| Keynote  | Parenteral nutrition in trauma patients   |
| Oral 6-1 | Utility of quick SOFA and quick SOFA plus lactate to predict 24 hour mortality in patients with severe trauma |
| Oral 6-2 | Clinical Significance of Malnutrition Risk in Severe Trauma Patients: A Single Center Study                   |
| Oral 6-3 | The Effect of Vitamin D Supplementation in Acute Traumatic Brain injury Patients                              |
| Oral 6-4 | Prediction of survival with modified shock index in chest trauma patients                                     |



## 외상환자에서 정맥영양수액 공급

박 효 정

삼성서울병원 약제부

외상을 입은 환자는 외상 초기에 전신성 염증반응증후군(Systemic Inflammatory Response Syndrome)을 경험한다. 이 시기, 체내에서는 포도당신합성, 면역반응, 상처 치유 등을 하기 위해 저장되어 있던 단백질, 지질, 글라이코젠을 빠르게 이동하는 이화상태가 되어 많은 열량과 영양소를 사용한다. 초기 영양 공급은 전신 염증을 감소시키는 데 도움이 될 수 있으므로 외상 후 소생이 완료되면 입원 후 24~48시간내 빠르게 영양 공급을 고려한다.

영양 공급을 시작할 때 영양 검색과 인체계측(anthropometry), 혈액 검사 결과를 바탕으로 적절한 영양 평가를 시행하고 환자에게 적합한 영양 요구량을 산출해야 한다.

외상 후 초기 영양 공급은 단백질과 열량 부족으로 인한 영양불량상태를 개선시키는 것보다는 면역조절에 더 의미가 있다. 최근에는 개복된 상태나 장이 노출되어 있는 상태의 환자에서도 경장영양을 하도록 권고하고 있다. 그러나 장폐색, 단장증후군, 과도하게 배출이 많은 누공(high output fistula)이 있는 환자와 같이 경구나 경관으로 영양공급이 어려울 경우에는 정맥영양 공급을 고려해야 한다.

환자에게 필요한 1일 열량 요구량을 산출하는 표준 방법은 간접열량측정기(indirect calorimetry)를 이용하는 것이다. 간접열량측정기는 호흡 가스를 측정하여 체내 산소 소모량과 이산화탄소 발생량을 분석하여 체내 목표열량을 산출하는 기계이다. 그러나 대부분의 병원에서는 간접열량측정기를 보유하고 있지 않고 간접열량측정기를 적용하고 해석하는 데 많은 어려움이 있어 수식을 이용하여 1일 열량요구량을 산출한다. 수식을 이용한 1일 열량 요구량 산출은 환자의 임상상태를 충분히 반영하지 않으므로 환자에게 적용 시 주의가 필요하다. 일반적으로 중환에서는 20~25 kcal/kg/day를 공급하고 환자가 회복단계가 되면 25~35 kcal/kg/day로 열량을 증량하여 공급한다. 과도한 열량 공급은 지방간, 고혈당, 호흡 부전 등을 일으킬 수 있으며 부족한 열량 공급은 상처 치유 지연, 장기부전, 면역저하 등을 일으켜 치사율을 증가시킬 수 있다.

적절한 열량과 영양소 공급에도 불구하고 외상환자는 상처에서 발생한 삼출물이나 복부 배출과 배뇨 등으로 많은 양의 단백질을 체외로 배출한다. 이때 체외에서 단백질을 공급하면, 체내 단백질 합성 속도는 변화시킬 수는 없으나 단백질 대사 속도를 부분적으로 감소시킬 수 있다. 외상 환자에서 일반적으로 권고되는 단백질 요구량은 1.5~2.0 g/kg/day이며 단백질 공급으로 인한 질소혈증이 발생하지 않으면 환자 상태에 따라 3~4 g/kg/day까지 공급이 가능하다. 단백질 공급량의 적절성은 외부에서 공급된 단백질량에서 체외로 배출된 단백질량을 측정하여 질소평형(nitrogen balance)를 측정하여 평가하지만, 외상환자는 상처나 배출관 등으로 단백질 배출량을 정확하게 측정하기 어려운 경우가 많아 초기 영양 공급 시에는 권고되지 않는다.

탄수화물은 중추신경계 기능유지를 위해 최소 120 g/day를 공급하고 글루코즈 투여 속도를 최대 4~7 mg/kg/min으로 공급한다. 영양집중지원을 시행하는 동안 혈당은 140~180 mg/dL를 유지하는 것을 권고한다.

지질은 필수 지방산과 높은 열량 공급을 위해 투여해야 한다. 정맥영양으로 공급하는 지질의 종류는 콩유, 올리브유, 어유, 중쇄지질이 있다. 환자를 위한 가장 좋은 지질의 종류에 대해서는 논란 중으로 연구가 진행 중이다.

아직까지 외상환자를 위한 비타민이나 미량원소 공급에 관련된 권고사항은 1일 요구량을 공급하는 것이나, 최근 항산화 비타민

## "Go Together"

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

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과 미량원소 공급에 대한 연구가 진행 중이다.

외상 후 생명의 소생과 유지를 위한 치료가 완료되면, 적절한 영양 공급이나 영양집중치료를 시행하여 환자의 치료 효과를 향상시킬 수 있다.

## Utility of Quick SOFA and Quick SOFA Plus Lactate to Predict 24 Hour Mortality in Patients with Severe Trauma

Il Jae Wang<sup>1</sup>, Junepill Seok<sup>2</sup>

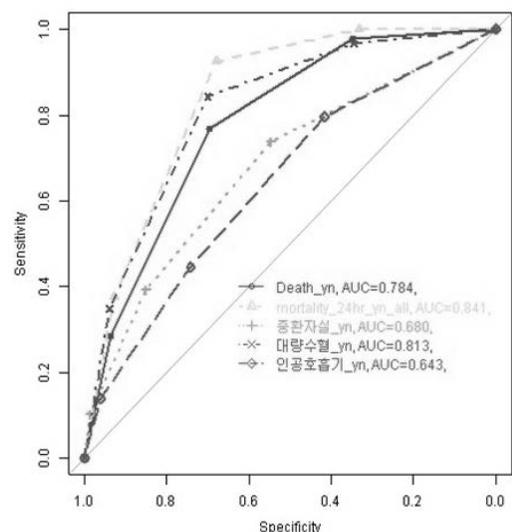
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**Objective:** The qSOFA (quick Sequential Organ Failure Assessment) score was recently introduced and validated among patients with and without suspected infection. However, the study on the use of qSOFA in the trauma setting was limited. This study aimed to assess the predictive value of qSOFA for mortality in patients with trauma. And since lactate is a well-established early indicator of outcomes, we also evaluated the predictive value of qSOFA plus lactate.

**Methods:** We performed a single center, retrospective study for patients who presented trauma center emergency room (TER) between 2016 and 2017. We calculated the qSOFA and qSOFA plus lactate based on initial value on TER presentation. qSOFA scores were the sum of 3 binary variables ( $RR \geq 22$ ,  $SBP100 \leq$  mmHg, and  $GCS \leq 13$ ). qSOFA plus lactate were calculated by adding an extra-point to qSOFA score in patients who met lactate thresholds of  $\geq 4$  mmol/L.

**Results:** A total of 1127 patients were included. Median age was 52 years, 78% were men, median Injury Severity Score was 17, and in-hospital mortality rate was 8.4%. For 24 hour mortality, the area under the receiver operating characteristic (AUROC) of the qSOFA scores was 0.841 (95% confidence interval[CI] 0.800-0.882), and that for qSOFA plus lactic acid was 0.880 (95% CI 0.843-0.918). For in-hospital mortality, the AUROC of the qSOFA scores was 0.784 (95% CI 0.744-0.823), and that for qSOFA plus lactic acid was 0.804 (95% CI 0.765-0.844).

**Conclusion:** Both qSOFA and qSOFA plus lactate are associated with mortality in patients with trauma. Both scores may be useful in trauma setting.



## Clinical Significance of Malnutrition Risk in Severe Trauma Patients: A Single Center Study

Ho Hyun Kim, Dong-Yeon Ryu, Chan-Ik Park, Sang-Bong Lee, Kwang-Hee Yeo, Seon-Uoo Choi, Seon-Hee Kim, Jae-Hun Kim, Hyun-Min Cho, Geon-Hee Hong

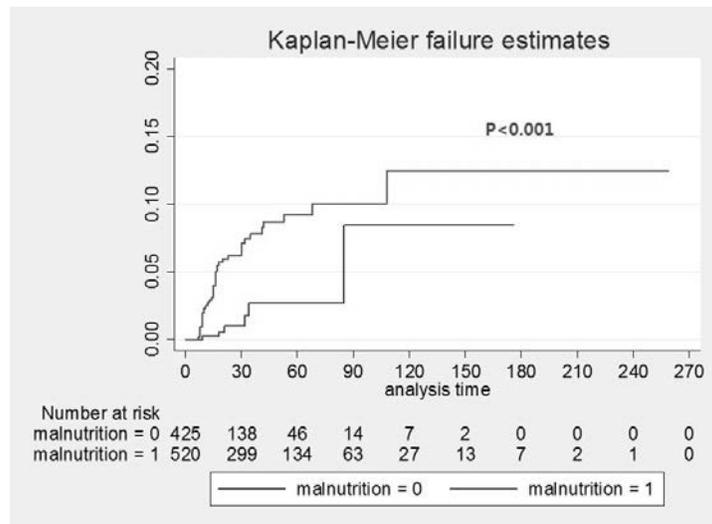
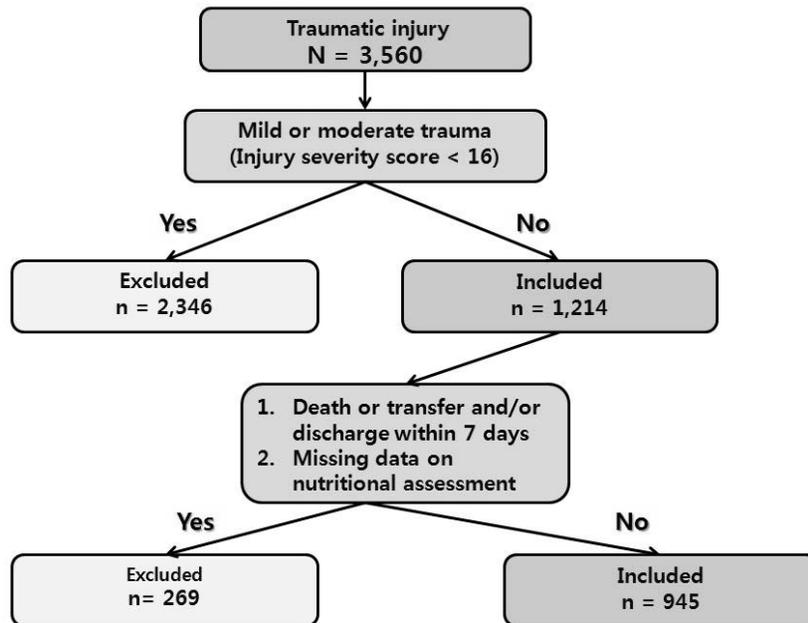
Pusan National University Hospital, Busan

**Objective:** Suboptimal nutritional status is often observed among hospitalized patients across all medical/surgical specialties. The objective of the present study was to (1) analyze the prevalence of malnutrition in hospitalized trauma patients and (2) to evaluate the relationship between malnutrition and selected clinical outcomes.

**Methods:** The retrospective study was conducted between July 2017 and December 2018 in Pusan National University Hospital Trauma Center with a total number of 3,560 patients. Nine hundred and forty five patients (945) were enrolled in this study. Patients were checked for malnutrition using Pusan National University Malnutrition Screening, which include serum albumin, ratio of actual body weight to ideal body weight (%), total lymphocyte count, appetite, and dysphagia, within 24 hours and after 7 days of hospitalization, respectively. Clinical outcomes under consideration included 1) mortality, 2) length of hospitalization, and 3) length of stay in intensive care unit.

**Results:** Total prevalence of malnutrition in hospitalized trauma patients was 55.0% (520/945). Patients at risk for malnutrition demonstrated older age ( $47.3 \pm 18.6$  vs.  $55.4 \pm 17.5$  years,  $p < 0.001$ ) and higher injury severity score (22 (17-27) vs. 25 (22-29),  $p < 0.001$ ). Furthermore, patients at risk for malnutrition showed prolonged hospitalization (22 (15-34) vs. 35(20-61) days,  $p < 0.001$ ) and prolonged length of stay in intensive care unit (3(2-8) vs. 10 (4-20) days,  $p < 0.001$ ). Furthermore, malnutrition risk was the independent prognostic factor of mortality in severe trauma patients (adjusted odds ratio 3.164; 95% confidence interval 1.283-7.800,  $p = 0.012$ ).

**Conclusion:** Malnutrition is widespread regarding hospitalized patients with severe trauma and results in sub-optimal clinical outcome. Thus, the high-risk patients for malnutrition (the elderly and patients with higher injury severity score and longer length of stay and/or intensive care unit stay) should be monitored carefully during hospitalization. Furthermore, the role of nutrition support team is paramount to the care of severely injured patients.



## The Effect of Vitamin D Supplementation in Acute Traumatic Brain Injury Patients

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<sup>2</sup>Samsung Changwon Hospital, Sungkyunkwan University School of Medicine

**Objective:** We have investigated the acute and long-term effects of vitamin D supplementation on the recovery of traumatic brain injury (TBI) patients.

**Methods:** A retrospective study was conducted on 345 patients with TBI who visited a single trauma center. From August to December 2016, serum levels of vitamin D were measured without vitamin D supplementation having been administered at the time of admission, 1 month, and 3 months post-TBI (control). From January 2017, vitamin D supplementation was provided to TBI patients with low serum levels of vitamin D at admission (supplement). The outcomes were investigated by assessing performance function [Extended Glasgow Outcome Scale (GOS-E)] and cognitive function [Mini-Mental Status Examination (MMSE) and Clinical Dementia Rating (CDR)] at 1 week and 3 months post-TBI.

**Results:** The mean serum level of vitamin D in TBI patients at admission was  $13.62 \pm 9.01$  ng/ml. The serum level of vitamin D significantly increased from  $14.03 \pm 8.68$  ng/ml at admission to  $37.42 \pm 12.57$  ng/ml at 3 months post-TBI in the supplement group ( $p < 0.001$ ). Improvement in GOS-E was observed from the first week to 3 months post-TBI, and both total TBI ( $p = 0.003$ ) and mild-to-moderate TBI ( $p = 0.002$ ) showed significant improvement with supplementation. In addition, the recovery of cognitive outcomes (MMSE/CDR,  $p = 0.042/p = 0.044$ ) from the first week to 3 months was significantly higher in the supplement group.

**Conclusion:** Supplementation of vitamin D in mild-to-moderate TBI patients may aid recovery from TBI and improve performance and cognitive outcomes.

## Prediction of Survival with Modified Shock Index in Chest Trauma Patients

Dowan Kim, Inseok Jeong, Su Hyang Lee

Chonnam National University Hospital

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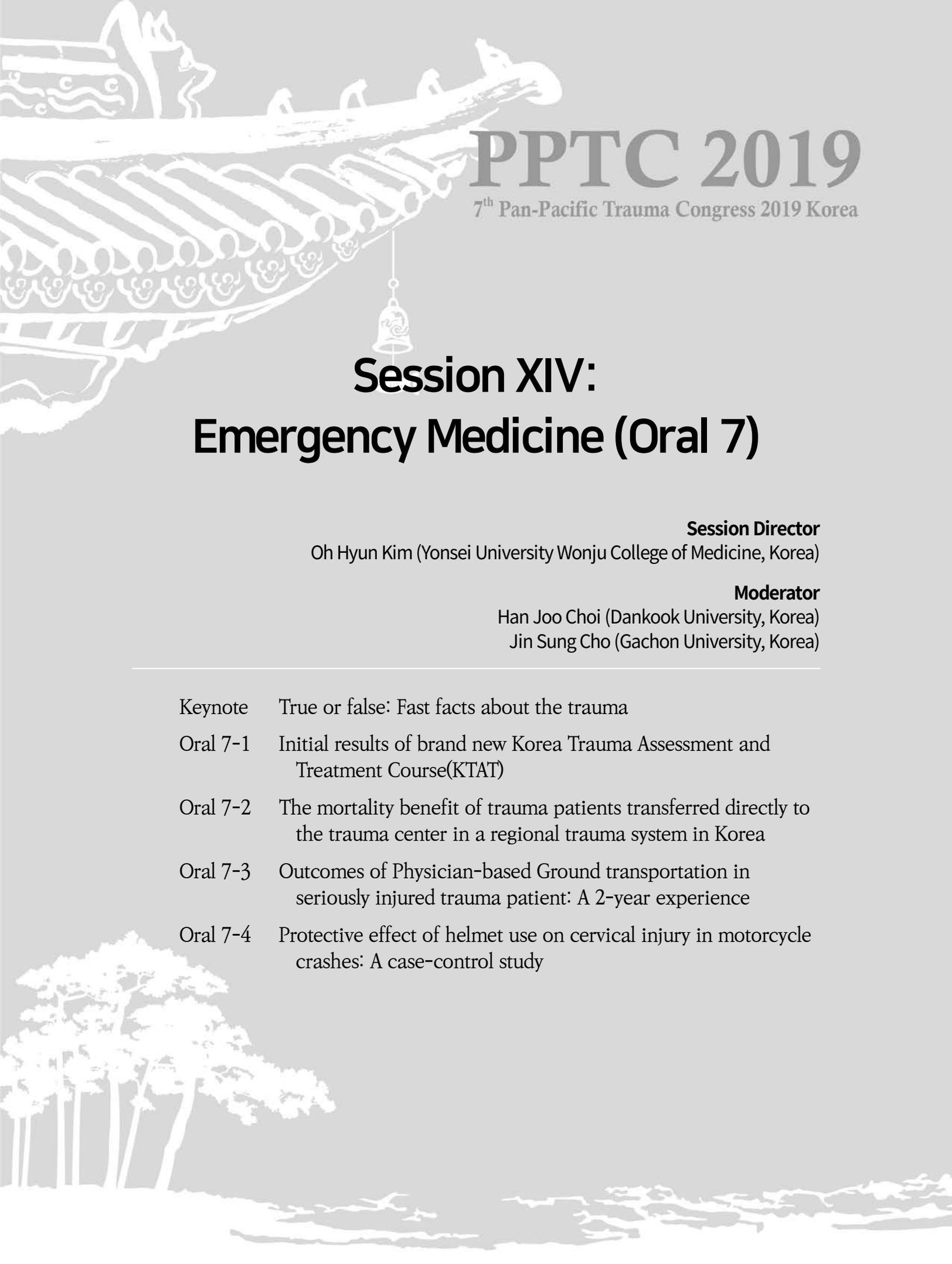
**Purpose:** Although Trauma and Injury Severity Score (TRISS) is regarded as the international standard for prediction of survival rate, its application is limited in patients without spontaneous breathing. Modified Shock Index (SI), defined by the ratio of heart rate to mean blood pressure, has been suggested as a simple marker to predict the severity of hypovolemic shock. We evaluated the effectiveness of modified SI as a predictor of mortality in chest trauma.

**Methods:** We respectively reviewed the medical records of patients who underwent ECMO for cardiogenic shock between January 2015 and May 2018. A total of 1656 patients was diagnosed as chest trauma. Of these, 827 patients was included in this study. These patients were divided into survivor and nonsurvivor groups, based on survival to hospital discharge. We compared the results of trauma scoring system in these patients, including Injury Severity Score (ISS), Revised Trauma Score (RTS), Glasgow Coma Scale (GCS), TRISS and modified SI.

**Results:** Mean age was  $55 \pm 19.2$  (range, 1-90) years and 230(27.8%) patients were female. Median ISS was 17 (range, 1-59) and median modified SI was 3 (range, 0-33). The optimal cut-off value of GCS, ISS, RTS, TRISS and modified SI for survival prediction was 13 (AUC 0.834,  $p < 0.457$ ).

**Conclusion:** Although the modified SI is a simple and feasible method to predict survival, it was not a more accurate tool of predicting mortality compared to other trauma scoring systems.





# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Session XIV: Emergency Medicine (Oral 7)

### Session Director

Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)

### Moderator

Han Joo Choi (Dankook University, Korea)

Jin Sung Cho (Gachon University, Korea)

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|----------|---|
| Keynote  | True or false: Fast facts about the trauma  |
| Oral 7-1 | Initial results of brand new Korea Trauma Assessment and Treatment Course(KTAT)   |
| Oral 7-2 | The mortality benefit of trauma patients transferred directly to the trauma center in a regional trauma system in Korea |
| Oral 7-3 | Outcomes of Physician-based Ground transportation in seriously injured trauma patient: A 2-year experience              |
| Oral 7-4 | Protective effect of helmet use on cervical injury in motorcycle crashes: A case-control study                          |



## FAST Facts about the Trauma

Wook-jin Choi

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Ultrasonography performed during the resuscitation procedure is called Focused Abdominal Sonography for Trauma (FAST). In the United States, it is the initial evaluation of trauma patients with blunt trauma and penetrating trauma. Ultrasonography is part of Advanced Trauma Life Support (ATLS), an effective tool for the diagnosis of hematomas, a part of the secondary evaluation of professional trauma resuscitation, and emergency surgery for hemodynamically unstable trauma patients. It is a tool that can help to classify whether to perform CT or angiography.

Recently, ultrasonography has been replaced by Diagnostic Peritoneal Lavage (DPL) as an initial evaluation tool for trauma patients, and it is helpful to diagnose cardiac damage by detecting pericardial effusion and pericardial effusion in trauma patients. Traumatic hemothorax and pneumothorax is also useful for diagnosis with ultrasound.

Ultrasonography helps to reduce the time spent at the emergency center by making quick decisions when surgical treatment is needed, and helps to quickly determine if an important procedure such as chest tube insertion is needed.

In addition, the examiner can increase the sensitivity of the ultrasound through continuous and repetitive examinations and obtain important information when the clinical condition of the patient changes. Finally, the limitation of ultrasonography is that the possibility of intraperitoneal injury, which is necessary for surgery, can not be totally excluded even if hemorrhagic negative findings are present.

In summary, the on-site lesion assessment ultrasound plays an important role in the treatment of trauma patients with blunt trauma and penetrating trauma and is becoming more and more common. In addition, due to the development of ultrasound devices, it is becoming more compact and lightweight, and it is expected to be utilized in the treatment process of various trauma patients.

## Initial Results of Brand New Korea Trauma Assessment and Treatment Course (KTAT)

Pil Young Jung, Oh Hyun Kim

Wonju Severance Christian Hospital

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**Introduction:** Trauma is main cause of death in South Korea and most common problem for the economically active population. In South Korea, preventable death rate of trauma is gradually decreasing from 50.4% in 1997 through improvement of trauma system. However, trauma education is also an important part of improvement as well as trauma system.

**Material & Methods:** Korea Trauma Assessment and Treatment Course(KTAT) has been operated from 2010 to 2018, 22th KTAT totally. In 2014, the 1st revision of education program was made and 2nd revision was made in 2017 and then the 4th version of KTAT is currently in use. Before 3rd revision was made, questionnaire survey for need of changing an education program was conducted. KTAT was converted into more practical simulation education rather than lecture based on results of the survey.

**Results:** A total of 245 respondents were surveyed and 229(93.5%) of them answered that KTAT needs to change simulation training. After the 3rd revision, 272 providers were trained through a total of 13 KTAT, 268 trainees (98.5%) received certification. 74(27.2%) of all participants were trained instructor course and 80(29.4%) was resident of emergency medicine. 92(33.8%) providers were a primary doctor working local emergency hospital and 24(8.8%) was military doctors. 173(63.6%) of total providers were department of emergency medicine, 37(13.6%) surgery, 11(4%) thoracic and cardiovascular surgery, 7(2%) neurosurgery, 8(2%) orthopedic surgery, 4 family medicine, and 1 obstetrics and gynecology. For educational satisfaction questionnaire, process evaluation was made with the 5 points Likert scale by providers. Satisfaction with education was high overall. (4.40-4.69). Reliability of the constructs was evaluated through Cronbach's alpha, is more than 0.90.

**Conclusions:** In order to continuously develop KTAT, it is necessary to have integrated professional organization and then it is possible to maintain standard education with continuous interest and enthusiasm.

## The Mortality Benefit of Trauma Patients Transferred Directly to the Trauma Center in a Regional Trauma System in Korea

Oh Hyun Kim, Phil Young Jung

Yonsei University Wonju College of Medicine

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**Objective:** The purpose of this study was to evaluate the mortality rate in trauma patients transported to trauma center and those transported to nontrauma center.

**Methods:** Retrospective cohort studies were used to collect patient information based on NEDIS data(2014. 1 ~ 2016.12). ICISS and survival risk ratios were calculated based on the ICD diagnosis, and classified into two groups: direct trauma center and non-trauma center. Demographic information and survival rates of patients with ICD-derived injury severity score (ICISS)

**Results:** This study was supported by the National Emergency Medical Information Network (NEDIS). Of the trauma patients were retrospectively reviewed. A total of 366,6672 patients were included in the study period, including 257,677 trauma center patients and 3,408,995 non - trauma center patients, and the area under the ROC curve of predicted mortality by ICISS was 0.769. The statistical significance of mortality between the two groups was higher in the trauma center direct trauma group in trauma patients less than ICISS 0.9. (odds ratio: 1.303, 95% confidence interval: 1.180-1.439)

**Conclusion:** In trauma patients below ICISS 0.9, the initial transfer to the trauma center reduced the mortality rate of trauma patients.

## Outcomes of Physician-based Ground Transportation in Seriously Injured Trauma Patient: A 2-year Experience

Seongho Choi, Kyuhyuk Kyung, Seongjib Kim, Jihoon Kim, Seongkyun Park, Minae Keum

Ulsan University Hospital, Ulsan, Korea

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**Objective:** In seriously injured trauma patients, major causes of preventable deaths in phase of prehospital period are inappropriate airway management, fluid resuscitation, delayed hemorrhage control and tension pneumothorax. The presence of physician seems to be beneficial for pre-hospital management and interfacility transportation of seriously injured trauma patient. But benefits of physician-based ground transportation (PBGT) is not yet established.

**Methods:** We reviewed trauma patients with injury severity score (ISS)  $> 15$  who were transported from another hospital from 2017 to 2018. A total of 424 patients are enrolled, 86 patients were transported by PBGT, 338 patients were transported by non-PBGT. Outcomes were evaluated with time to definitive treatment, emergency department length of stay, in-hospital mortality and w-score.

**Results:** ISS is  $31.3 \pm 12.9$  in PBGT,  $24.3 \pm 8.6$  in non-PBGT. ( $P < 0.001$ ) TRISS is  $0.627 \pm 0.371$  in PBGT,  $0.829 \pm 0.237$  in non-PBGT. ( $p < 0.001$ ) Emergency department length of stay is  $102 \pm 68$  minute in PBGT,  $131 \pm 99$  minute in non-PBGT. ( $p = 0.012$ ) Time to definitive treatment is  $279 \pm 111$  minute in PBGT,  $339 \pm 174$  minute in non-PBGT. ( $p < 0.001$ ) Death rate is 26.7% in PBGT, 11.8% in non-PBGT. ( $p = 0.001$ ) w-score is 10.51 in PBGT group and 5.27 in non-PBGT group.

**Conclusion:** PBGT shows better outcome in time to definite treatment, emergency department length stay, in-hospital mortality and w-score.

## Protective Effect of Helmet Use on Cervical Injury in Motorcycle Crashes: A Case-control Study

Gwan-Jin Park<sup>1</sup>, Jaeho Shin<sup>2</sup>, Sangchul Kim<sup>1</sup>, Dae-Seok Na<sup>1</sup>, Hae-Ju Lee<sup>1</sup>,  
Hoon Kim<sup>1</sup>, Seok-Woo Lee<sup>1</sup>, Young-Nam In<sup>1</sup>

<sup>1</sup>Chungbuk National University Hospital, <sup>2</sup>Kyungil University

**Objective:** Helmet use during motorcycle crashes has been shown to reduce traumatic brain injury and mortality. However, preventive effects of its use on cervical spine injury remain controversial. In this study, we evaluated whether helmet use can reduce cervical spine injury during motorcycle crashes.

**Methods:** A case-control study using data from the Emergency Department-based Injury In-depth Surveillance (EDIIS) registry was conducted. Cases were defined as patients with cervical spine injury [ $\geq 2$  points in the Abbreviated Injury Scale (AIS)] in motorcycle crashes from 2011 to 2016. Four controls were matched to one case with strata which included age and sex from the EDIIS registry. Primary outcome was cervical spine injury, secondary outcome was intensive care unit (ICU) admission, and tertiary outcomes were mortality. Multivariable logistic regression analysis was used to calculate odds ratios (OR) with 95% confidence intervals (CIs) to evaluate the associations between helmet use and related outcomes.

**Results:** In total, 2,600 patients were analysed; among these, 1,145 (44.0%) used helmets at the time of crashes. The helmet group showed lower alcohol consumption and mortality rates than the no helmet group (alcohol: 3.2% vs. 9.2%, respectively, and mortality: 2.4% vs. 7.1%, respectively;  $p < 0.01$ ). Compared with the no helmet group, the helmet group was less likely to have cervical spine injury [adjusted OR, 0.62 (0.51-0.77)]. In addition, helmet use has been shown to help prevent ICU admission and mortality [adjusted OR, 0.45 (0.36-0.56) and 0.32 (0.21-0.51), respectively].

**Conclusion:** Helmet use was found to have significant preventive effects on cervical spine injury during motorcycle crashes.





# PPTC 2019

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## Poster-Oral Presentation





## Facial Injuries in Handball: A Survey of Handball Coaches

Kun Hwang

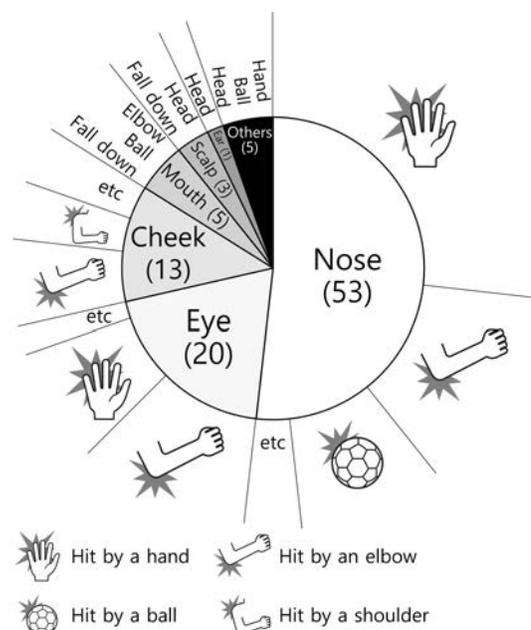
Inha University School of Medicine

**Objective:** The aim of this study was to investigate the occurrence of facial trauma in handball players in South Korea.

**Methods:** Forty-one handball coaches responded to an 11-item standardized questionnaire. Twenty-three coaches (56.1%) stated that their players had experienced a facial injury, and reported 56 cases.

**Results:** The nose was the most common site of the injuries (51.7%), followed by the eye (19.6%) and cheek (12.5%). The most common causes of nose injuries were being hit by a hand (26.8%), elbow (12.5%), and ball (8.9%). Most of the nose injuries were fractures (41.1%). The most common causes of the injuries were being hit by a hand (37.5%), elbow (30.3%), and ball (16.1%). The most common type of facial injury was fracture (41.1%), followed by contusion (26.8%), and laceration (21.4%). The most common position of the player was pivot (25.0%), followed by center back (21.4%), and right back (19.6%). Among the facial injuries experienced by pivots, the nose (12.5%) was the most common site, followed by the eye (8.9%). The most common causes of the injuries in pivots were being hit by a hand (12.5%) and an elbow (12.5%). The mean convalescence period after the facial injuries was  $3.2 \pm 1.6$  weeks. No respondents stated that their players wore a mouthguard.

**Conclusion:** Team doctors should be aware of the high frequency of nasal bone fractures and prepare for them. A suture set should be prepared for lacerations. If a player is hit in the eye by a ball, the possibility of retinal injury should be considered.



**Figure 1.** Sites and causes of facial injuries. etc: et cetera.

## Safety of Surgical Hip Dislocation in Femoral Head Fracture-dislocation

Jeong Heo<sup>1</sup>, Chang-Wug Oh<sup>1</sup>, Joon-Woo Kim<sup>1</sup>, Kyeong-Hyeon Park<sup>1</sup>, Jong-Keon Oh<sup>2</sup>, Seo Il<sup>1</sup>

<sup>1</sup>Kyungpook National University Hospita, <sup>2</sup>Korea University Hospital

**Objective:** Surgical hip dislocation(SHD) has been recommended for femoral head fracture-dislocation(FHFD), but its safety to escape from avascularity of femoral head has not confirmed yet. We investigated viability of femoral head with a radio-scintigraphy or MRI and functional outcome, in patients underwent SHD in FHFD.

**Methods:** Thirty-five patients with FHFD had underwent SHD in our institution(from 2009 to 2017). To investigate the avascularity of femoral head, single-photon emission computed tomography(SPECT), bone scan or MRI was performed, at 30 weeks after injury. Its safety was defined as no evidence of avascular necrosis(AVN) on plain x-ray at postoperative  $\geq 1$  year with normal radio-scintigraphy or MRI, or no evidence of AVN on plain x-ray at postoperative  $\geq 2$  years without the further study. Excluding 3 cases, thirty-two out of 35 cases were included (mean follow-up 145.6 weeks, mean age(36.9 years). In Pipkin's classification, there were 4 of type I, 5 of type II, 2 of type III, and 21 of type IV. Regardless of the presence of acetabular fracture, there were 29 cases of head fracture and 3 cases of associated femoral neck fracture. Radiological outcome(using Matta's grading) and Harris hip score(HHS) were evaluated at latest follow-up.

**Results:** Thirty(93.75%) of 32 cases survived without any evidence of avascularity. Two(6.25%) cases showed AVN (one of Pipkin type III, one of type IV), which associated the displaced femoral neck fracture. Presence of femoral neck fracture was important factor with the development of AVN( $p=0.006$ ), while Pipkin classification was not( $p=0.748$ ). In Matta's grading, 8 were excellent, 18 were good, 5 were fair, and 1 was poor. HHS score was 81.53 in average, and significantly lower in AVN group( $p=0.004$ )

**Conclusion:** Unless femoral neck fracture is associated, SHD in FHFD is a safe and effective procedure to achieve satisfactory radiological and functional outcomes, with minimal risk of AVN.

## Posterior Pelvic Ring Injury of Straddle Fractures: Incidence, Fixation Methods, and Clinical Outcomes

Yong-Cheol Yoon<sup>1</sup>, Hyung Keun Son<sup>2</sup>, Jong-Keon Oh<sup>3</sup>

<sup>1</sup>Gachon University Gil Hospital, <sup>2</sup>Ajou University School of Medicine, <sup>3</sup>Korea University Guro Hospital

**Objective:** A pelvic fracture often causes severe bleeding and complications due to the high-volume blood supply to the pelvis and associated injuries of the internal organs. This study aimed to determine the incidence of posterior pelvic ring injury in patients with a straddle fracture, analyze fixation methods for treating pelvic fractures accompanying straddle fractures, and investigate the clinical significance and importance of straddle fractures.

**Methods:** This study included 73 patients (41 men, 32 women) with a straddle fracture injury who were able to attend follow-ups for >1 year after January 2014. The injury mechanism, injury severity score (ISS), other accompanying injuries, presence of a posterior pelvic ring injury, and fixation methods for the pelvic fracture were analyzed, and the outcomes were evaluated functionally and radiologically.

**Results:** Of the 73 patients, 56 (77%) had a posterior pelvic ring injury and 7 died. In 43 patients, the posterior pelvic ring injuries were treated surgically as the patients were diagnosed with an unstable pelvic injury. The fixation method was determined based on the severity of the posterior pelvic injury and plate fixation of the anterior pelvic ring and screw fixation of the posterior pelvic ring were performed in most cases. The accompanying injuries included multiple fractures, abdominal organ injuries, and thoracic injuries; in order of increasing incidence, the mean ISS was 24.7 points.

**Conclusion:** Straddle fractures are not simple fractures limited to the anterior pelvic ring. Careful examination revealed that a posterior pelvic ring fractures may accompany straddle fractures, which implies the potential of pelvic injury instability; thus, special attention is required for patients with a straddle fracture

## Femoral Derotational Osteotomy: A Novel Method to Achieve an Accurate Correction Using Smartphone Application

Il Seo<sup>1</sup>, Chang-Wug Oh<sup>1</sup>, Kyeong-Hyeon Park<sup>1</sup>, Joon-Woo Kim<sup>1</sup>, Jong-Keon Oh<sup>2</sup>,  
Jeong Heo<sup>1</sup>, Sung-Soo Ha<sup>1</sup>, Jin-Han Lee<sup>1</sup>

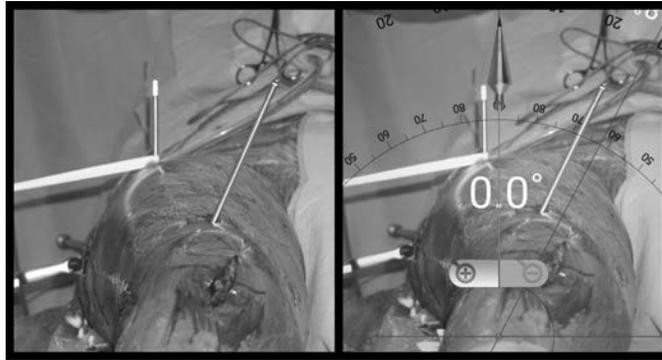
<sup>1</sup>Kyungpook National University Hospital, <sup>2</sup>Korea University, Guro Hospital

**Objective:** Rotational osteotomy is often required in congenital or acquired deformity as well as traumatic malunion. However, it is difficult to know the accurate measurement of rotational correction angle on x-ray. To improve the accuracy and perform an easy calculation of corrective angle, we introduce a novel method using smartphone application to measure the corrective angle, intra-operatively.

**Methods:** Intraoperatively, two parallel Schanz pins were inserted at the anterior femur shaft; one at the proximal one-third level and the other at the distal one-third level. Percutaneous osteotomy was performed at the mid-diaphysis or malunion site. Derotation of the distal fragment is then performed using the Schanz pins as joysticks internally or externally until desired angle. Smartphone application (Home Toolbox, Everyday Tools, iOS or Smart Protractor, Smart Tools<sup>®</sup>, Android) was intraoperatively used to measure the desired angle between proximal and distal pins. Holding two pins with temporary external fixator, intramedullary nailing or submuscular plating was performed. Seventeen cases were prospectively performed with rotational deformity or malunion. We compared between desired angle by smartphone application and corrected angle by postoperative CT.

**Results:** The mean desired angle during operation was 23.7°(range 10.2~45.8), mean postoperatively corrected angle was 22.6°(range 8.7~47.9). The mean difference of desired angle and postoperative correction angle was 1.97°. Both measurements using smartphone application and CT demonstrated a positive correlation, significantly (Pearson correlation coefficient:  $r=0.949$ ,  $p<0.001$ ). Two cases of bent Schanz pins and one case of broken Schanz pin, which caused by manual handling of pins at the time of rotational correction, were developed. All cases achieved the primary union. There was no major complication, including implant breakage, nonunion and infection.

**Conclusion:** This current study shows that smartphone application is an accurate method in measuring the corrected angles in femoral derotational osteotomy.



## Errors in Trauma Preventable Death: A Review of Consecutive Trauma Deaths for Three Years

Byungchul Yu, Mina Lee, Jungnam Lee, Kangkook Choi, Giljae Lee

Gachon University

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**Objective:** Trauma deaths can be preventable if the trauma system is well established. Several trauma centers were established in Korea. However, the system and trauma centers are not matured until now. The aim of this study is to show characteristics of trauma death and to reveal death related errors in premature trauma center.

**Methods:** We analyzed 443 consecutive deaths associated with trauma for 3-year period. Variables including Glasgow Coma Scale (GCS), Revised Trauma Score (RTS) and Trauma and Injury Severity Score (TRISS) were evaluated. The result of trauma death review was also analyzed.

**Results:** 286 (69.6%) patients were male and mean age was 56.4 years. Most of patients (96.6%) were injured by blunt mechanism. Mean ISS was 22 and median RTS, TRISS were 1.89, 0.16, respectively. The most frequent cause of death was traumatic brain injury (TBI). We identified 42 errors in two definitive preventable (DP) and thirty-one potentially preventable (PP) patients.

**Conclusion:** A review of all trauma-related death can improve trauma center performance.

## Radiologic Factors Predicting Deterioration of Mental Status in Patients with Acute Traumatic Subdural Hematoma

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**Objective:** To evaluate whether subdural hematoma(SDH) volume and other radiologic factors predict deterioration of mental status in patients with acute traumatic SDH.

**Methods:** SDH volumes were measured with a semiautomated tool. The area under the receiver operating characteristic curve was used to determine optimal cutoff values for mental deterioration, including the variables midline shift, SDH volume, hematoma thickness, and Sylvian fissure ratio. Multivariate logistic regression was used to calculate the odds ratio for mental deterioration based on several predictive factors.

**Results:** We enrolled 103 consecutive patients admitted to our hospital with acute traumatic SDH over an 8-year period. We observed an increase in SDH volume of approximately 7.2 mL as SDH thickness increased by 1 mm. A steeper slope for midline shift was observed in patients with SDH volumes of approximately 75 mL in the younger age group compared with patients in the older age group. When comparing cutoff values used to predict poor mental status at time of admission between the 2 age groups, we observed smaller midline shifts in the older patients.

**Conclusion:** Among younger patients, an overall tendency for more rapid midline shift progression was observed in patients with relatively low SDH volumes compared with older patients. Older patients seem to tolerate larger hematoma volumes owing to brain atrophy compared with younger patients. When there is a midline shift, older patients seem to be more vulnerable to mental deterioration than younger patients.

## The Trend of Traumatic Head Injury in Relation to Monthly Variations at One Institution

Ki Seong Eom, Eun Sung Park, Seong Keun Moon

Wonkwang University Hospital

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**Objective:** In this paper the authors present their experience in relation to monthly variations treating patients with traumatic head injury (THI) who was admitted to Wonkwang University Hospital.

**Methods:** A retrospective review of 327 patients (pts) with THI between January 2015 and December 2016 was performed. The mean patient age was 56.2 years. There were 238 men and 89 women. The mean Glasgow Coma Scale (GCS) score on admission was 12.7. The emergency operation was performed in 103 patients (31.5%). The cause of injury was fall in 146 pts, traffic accident in 131 pts, hitting in 12 pts, and others in 38 pts. The diagnosis of injury was only skull fracture in 21 pts, traumatic subarachnoid hemorrhage (T-SAH) in 63 pts, traumatic intracerebral hematoma (T-ICH) in 30 pts, acute epidural hematoma (A-EDH) in 56 pts, acute subdural hematoma (A-SDH) in 147 pts, and A-EDH plus A-SDH in 10 pts.

**Results:** The most incidence of THI was in December (39 pts) and the least was in February (18 pts) during the course of a year. The incidence rate of THI of Summer season was the highest (97 pts, 29.7%). The highest ratio of male patients was July (88.6%) and the lowest month was June (56.7%). The highest incidence of each day was Saturday (66 pts) and the lowest was Wednesday (39 pts). Between 13 and 18 o'clock, the most time of incidence of THI (39.8%).

**Conclusion:** Although this paper has many limitations of statistical problem, retrospective study, and analysis of single center, this paper is worthwhile, analyzing the trends of incidence of THI. This result would help to early detection, timely surgery, and appropriate treatment for variable THI pts.

## Preventive Effect of Safety Belt on Traumatic Brain Injury Resulting from Motor Vehicle Collisions in Occupants Classified by Age

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Yeon-Il Choo<sup>1</sup>, Kang-Hyun Lee<sup>2</sup>, Hee-Young Lee<sup>2</sup>, Ho-Jung Kim<sup>3</sup>

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<sup>3</sup>Soonchunhyang University Hospital Bucheon

**Objective:** Elderly occupants are more fragile than non-elderly occupants in motor vehicle collisions (MVCs). We sought to assess whether the preventive effect of safety belt on traumatic brain injury (TBI) from MVCs differ according to occupants' age.

**Methods:** This study was a retrospective observational study. This study evaluated crash data from 2011 to 2016 obtained from the Emergency Department-based Injury In-depth Surveillance (EDIIS) registry. Injured occupants were categorized by age into young adults (ages 18-35 years, n=35,032), middle-aged adults (ages 36-55 years, n=34,507), and older adults (aged older than 55 years, n=21,895). Primary endpoint was TBI, secondary endpoint was ICU admission, and tertiary endpoint was mortality. Multivariate logistic regression analysis was performed, and adjusted odds ratios (AORs) of subgroups were calculated for study outcomes adjusted for any potential confounders.

**Results:** Among a total 91,434 patients, 61,205 (66.9%) used seat belts at the time of crashes. In a model adjusted for potential confounders, compared with the unbelted group, the belted group was less likely to have TBI [AORs=0.62, 95% confidence interval (CI)=0.51-0.77]. In the comparison of AOR of subgroups for TBI, OR reduction was the highest in the young adults (AOR=0.389, 95% CI, 0.321-0.471), followed by middle-aged adults (AOR=0.395, 95% CI, 0.334-0.467) and older adults (AOR=0.488, 95% CI, 0.423-0.562). In addition, seat belt use had the effect to prevent ICU admission and mortality in all subgroups (AOR=0.59, 95% CI, 0.55-0.64 and AOR=0.18, 95% CI, 0.16-0.22, respectively).

**Conclusion:** The protective effects of seat belt on TBI, ICU admission, and mortality from motor vehicle collisions decreased with age.

## A Pilot Study of Surge Capacity in the Metropolitan Area of South Korea

Bo-Sun Sim, Young-Hoon Yoon, Sunghyuk Choi, Jung Youn Kim, Youngduck Cho

Korea University Guro Hospital

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**Introduction:** Seoul is the third most densely populated area in the world except for the city-state. However, a national disaster plan has not yet been established.

**Aim:** From September 2017, representatives of seven regional emergency medical centers in Seoul met monthly and decided to investigate basic data for the future establishment of surge capacity planning.

**Methods:** Staff, supply, space and systems for surge capacity were surveyed in seven hospitals. The additional surveyed data were as follows: hospital incident command system and actual operational experience; performance of disaster drill; safety and security plan; estimation of surge capacity in normal operating conditions and extreme operating conditions; alternative therapeutic spaces; back-up plan to call non-duty medical staff; decontamination equipment; contingency plan for staff shortage; etc.

**Result:** All the hospital reported they have hospital incident command system and held disaster drill every year, however, the two hospitals (28.5%) had no real experience of hospital incident command system activation. Five hospitals (71.4%) did not have safety and security plan. They replied they can treat average 7.7 emergency patients (Korean Triage and Acute scale (KTAS)  $\leq 3$ ), 10 non-emergent patients (KTAS $>4$ ), 0.9 surgical patients and 0.7 unstable patients simultaneously in normal operating conditions. In extreme operating conditions, they replied they can treat average 26.4 emergency patients (KTAS $\leq 3$ ), 54.3 non-emergent patients (KTAS $>4$ ), 3.7 surgical patients and 2.3 unstable patients simultaneously. The two hospitals (28.5%) had no alternative therapeutic spaces, no back-up plan to call non-duty medical staff and no contingency plan for staff shortage. Three hospitals (42.9%) did not have decontamination equipment.

**Discussion:** The survey revealed the basic data for surge capacity planning in Seoul. Data from hospitals other than regional emergency medical centers should be collected for the completion of disaster plans.

## Treatment Progress and Results of Patient with Penetrating 45-caliber Gunshot Injury

Gi Ho Moon<sup>1</sup>, Young Ho Lee<sup>2</sup>

<sup>1</sup>Armed Forces Capital hospital, Korea, <sup>2</sup>Seoul National University College of Medicine

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**Objective:** Recently, indiscriminate terrorism to the civilian in the worldwide has been arising. We should prepare proper medical service for disaster control as South Korea is not free from terrorism and war. The purpose of this article is to describe our experience with the first reported 45-caliber gunshot injury to extremity in Korea and to establish useful methods for the management of patients with combat-related injuries.

**Methods:** Korean tourist with a single Gunshot injury at Philippines in 16th July, 2018. The patient was transported through an airplane and arrived at our hospital about 30 hours after injury. He had 1 penetrating wound with tibia shaft fracture. He recovered after early initial management and appropriate surgery.

**Results:** About 2.0 cm-long bullet within the left tibialis anterior muscle at the mid-lower leg level with tibia shaft fracture. Metal bullet was removed and tibial fracture was treated by intramedullary nailing. There was no wound infection sign but delayed wound closure done. Complete bone union and good functional recovery with wound healing were gained.

**Conclusion:** Gunshot penetrating injuries to the extremities should be considered as open fractures. Foreign body removal with repeated wound debridement and delayed wound closure make a good result.

## The Effect of Orthopedic Trauma Surgeon Staying on Emergency Department

Jin-Kak Kim

Seoul National University Bundang Hospital

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**Objective:** When patients visit the emergency room(ER), staying time is important regardless their severity. Even though mild disease, there should be no unnecessary time consuming. Consultation system is different by department or by hospital but mainly internal medicine doctors staying emergency department and the other department response to on call consultation. We hypothesized this difference makes gap of patients staying time at ER.

**Methods:** An orthopedic trauma surgeon staying ER has treated trauma patient primarily, from January 2019. I compared patients staying time at ER who got the orthopedic injury, contact time from patient arrival and treatment decision time with electronic medical record before and after his working.

**Results:** Before his working mean patients staying time is 149 minutes. From patient's arrival, mean timing to on call consultation is 17 minutes, mean orthopedic doctors arrival timing is 24 minutes. And the time for decision making is 32 minutes. Comparing this, after his work, mean patients staying time is 80 minutes. Its' been only 9 minutes from arrival to decision making.

**Conclusion:** ER staying orthopedic trauma surgeon decrease the patients staying time dramatically. It is very helpful for trauma patient's treatment, especially time economic aspect.



# PPTC 2019

7<sup>th</sup> Pan-Pacific Trauma Congress 2019 Korea

## Poster Exhibition





## Combined Procedures in Traumatic Distal Tibal Bone Defect with Type 6 Physeal Fracture

Sanghyun Lee, Taeyoung Ahn, Chanlk Park, Changyu Lee

Pusan National University Hospital

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Traumatic injury of the medial malleolus may cause premature fusion of the growth plate, leading to progressive varus deformity, shortening of the ankle and joint instability in pediatric patients. The authors report the treatment results of traumatic medial malleolus defect with combined surgical techniques. A eight-year-old girl sustained a large soft tissue defect over the medial malleolus when a car drove over her. her radiograph showed a total defect of medial malleolus with partial loss of navicular, cuneiform, and 1st metatarsal bones. We performed infection control, medial malleolus reconstruction, soft tissue reconstruction, and corrective osteotomy in stages according to patient status. A eight-year-old girl sustained a large soft tissue defect over the medial malleolus when a car drove over her. her radiograph showed a total defect of medial malleolus with partial loss of navicular, cuneiform, and 1st metatarsal bones. We performed infection control, medial malleolus reconstruction, soft tissue reconstruction, and corrective osteotomy in stages according to patient status. A eight-year-old girl sustained a large soft tissue defect over the medial malleolus when a car drove over her. her radiograph showed a total defect of medial malleolus with partial loss of navicular, cuneiform, and 1st metatarsal bones. We performed infection control, medial malleolus reconstruction, soft tissue reconstruction, and corrective osteotomy in stages according to patient status.

## Venous Thromboembolism Following Delayed Surgery of a Hip Fracture

Eic Ju Lim, Ji Wan Kim, Jae Youn Yoon, Shin Seok Kim

Asan Medical Center

**Objective:** We aimed to evaluate the incidence of venous thromboembolism (VTE) in patients with hip fractures whose surgery was delayed, and the effect of prophylaxis intervention in preventing thromboembolic complications.

**Methods:** This study is a single-center, and retrospective cohort study. The medical records of patients who presented with fracture from Oct 2016 to Jul 2018 were retrospectively obtained. Inclusion criteria were following; 1) Surgically treated patients with hip fracture, 2) Surgical delay > 24 hours from injury to surgery. Our conventional protocol of prophylaxis for VTE was anti-embolism stocking without screening (group 1, n=82). From Sep 2017, intensive protocol for VTE was performed with indirect deep vein thrombosis (DVT) computed tomography (CT) and pulmonary embolism (PE) CT (group 2, n=64). Our prophylaxis protocol was consisted of mechanical prophylaxis and chemical prophylaxis. We compared the incidence of VTE between the two groups.

**Results:** 146 patients (44 males and 102 females) with a mean age of 77.9 years were enrolled. The percentage of transferred patients was 58.8%. The average time from injury to admission was 72.1 hours (range, 0.5-1464 hours), and the average time from admission to operation was 76.7 hours (range, 4-934 hours); The average time from injury to operation was 147.9 hours (range 25-1556 hours). Total 10 patients developed VTE (6.8%), of which 2 had DVT, 4 had PE and 4 patients had both DVT and PE. Six patients (9.4%) were screened on preoperative evaluation and all of them were group 2. The other 4 patients developed VTE postoperatively, and they were group 1. In the group 1, postoperative VTE occurred 4.8% (4/82) was higher than that 0% (0/64) in group 2 (p=0.009).

**Conclusion:** The patients with delayed hip fracture surgery showed a high prevalence of preoperative VTE, but our management protocol showed effective prevention of symptomatic VTE including PE.

## Flexible Bronchoscopy in Trauma Field; A View of Trauma Surgeon

Dongsub Noh, Jin Ho Choi

Eulji University Hospital

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**Objective:** Since the implementation of the flexible fiberoptic bronchoscope (FBS), FBS has played an important role in the diagnosis and treatment of tracheobronchial tree and pulmonary disease. FBS is often performed by an endoscopist, but it is rarely performed in a surgeon's view. We investigated the FBS that was surgeon's perspective.

**Methods:** In this retrospective study, FBS performed by single thoracic surgeon in Eulji University Hospital Trauma Center between March 2017 and December 2018 were analyzed for epidemiology, purpose, result and complications of FBS.

**Results:** Forty-six patients were received FBS, and repeated FBS was performed in nine patients. Their mean age was 57.60 years old. The injured main organ was brain (9), abdominal organ (7) cervical spine (4), extremities (4), flail chest (3), lung injury (3), aorta (2) and face (1). The average Injury Severity Score was 21.30. The purpose of FBS was atelectasis or haziness on chest x-ray (23), pneumonia (15), blood aspiration (2), foreign body removal (2), percutaneous tracheostomy (2) and intubation due to difficult airway (1). The results of FBS were mucous plug (26), blood aspiration (12), foreign body removal (2), percutaneous tracheostomy (2), difficult airway intubation (1) and negative finding (3). The reasons for repeated FBS were pneumonia (8) and atelectasis (5). There were no complications.

**Conclusion:** With sufficient practice, the FBS in the surgeon view is a bed-side procedure that is easy enough and safe to perform.

## Surgical Outcome of Distal Femoral Fracture in Elderly Patients Treated with MIPO: Can Percutaneous Cerclage Wiring Reduce Bone Healing Time?

Ki Chul Park, Jin Hwan Cheong, Je Il Ryu, Sun Kyun Ro

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**Objective:** The purpose of this study was to evaluate the patients who had undergone MIPO procedure with or without percutaneous wiring assisted reduction in distal femur fractures and to determine the effectiveness of this reduction technique on the reduction quality and fracture union.

**Methods:** Of the 94 patients with displaced distal femoral fractures who were treated at two hospitals between January 2009 and September 2017, 43 patients who were over 60 years old were enrolled in this study. 19 patients were operated with percutaneous cerclage wiring assisted reduction and MIPO technique (Group A) and the other patients were operated with MIPO technique alone (Group B). One or two cerclage wires were percutaneously applied for reduction, and then, internal fixation was performed with MIPO technique using LCP-DF.

**Results:** There were no statistically significant differences in demographic data between two groups. All cases achieved complete bony union without further surgical interventions at the latest follow up and the mean time to radiological union was 25.7 weeks. The time to bone union ( $22.05 \pm 9.45$  weeks vs.  $28.7 \pm 7.93$  weeks,  $p=0.015$ ) was significantly shorter in Group A. The degree of reduction was more accurately reduced in group A, but there was no significant difference in the degree of displacement. At the last follow-up, there was no difference in lower extremity function score and complication rate.

**Conclusion:** In patients with distal femoral fractures of the elderly, percutaneous cerclage wiring followed by MIPO shows favorable result with excellent reduction and a high union rate.

## Recurrent Pseudoaneurysm after Isolated Blunt Adrenal Gland Injury: A Very Rare Case

Wu Seong Kang, Chan Yong Park, Sora Ahn, Sung Nam Moon,  
Sang Hyun Seo, Hyun Seok Jung

Wonkwang University Hospital

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The isolated blunt traumatic adrenal hemorrhage which needs hemostasis is very rare. We report a case of successful treatment by repeated angioembolization for adrenal trauma without any other abdominal injuries. A 73-year-old male was admitted to our hospital due to blunt trauma by a traffic accident. Computed tomography (CT) revealed a right adrenal injury with a large amount of contrast blush without any other abdominal organ injury. Multiple rib fracture and left clavicle fracture was found in initial chest CT. His initial systolic blood pressure and hemoglobin levels were 90 mmHg and 7.9 g/dL, respectively. Angioembolization to adrenal gland artery was performed immediately. Thirteen days after admission, follow-up CT revealed newly large contrast blush from the adrenal gland, and repeat angioembolization was performed. The size of the hematoma sac had decreased on follow-up CT scan, and the patient was discharged to home without complication. In this case, we identified a very rare isolated blunt adrenal gland injury which induced significant hemorrhage and recurred. Furthermore, this case was successfully treated by angioembolization.

## Pericardial Injury with Cardiac Tamponade from Multiple Stab Injuries of the Trunk: A Case Report of the Incidental Release of Cardiac Tamponade

Pil Young Jung, Kwan Wook Kim

Wonju Severance Christian Hospital

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**Introduction:** Traumatic hemopericardium with cardiac tamponade is a rare but life-threatening condition. We report a successful treatment of hemopericardium with cardiac tamponade due to multiple stab injuries of the trunk.

**Case presentation:** From the regional local hospital, a 34-year-old male patient was transferred to our institution with multiple stab injuries of the trunk for suicide. At admission, a vital sign of the patient was unstable and led to arrest and was ROSC after 1 cycle CPR. The eFAST was a positive sign at pericardium and splenorenal space. CT scan taken at the previous hospital showed a hemopericardium and hemoperitoneum. We decided to the emergency operation of the chest and abdomen simultaneously. During opening the chest with median sternotomy, another arrest happened, we did open cardiac massage and the patient was ROSC after that performance. The surgical finding revealed a complete transection of Lt. internal mammary vessels causing hemopericardium. Epicardium of Rt. ventricle, the greater omentum, spleen were injured and we found diaphragm injury that may be a role as a pericardial window through the abdomen cavity. We performed ligation of Lt. internal mammary vessels, splenectomy, omentectomy and primary repair of the diaphragm. Patients recovered and discharged without any complication at 24 admission days.

**Conclusion:** We report a case of pericardial injury with cardiac tamponade caused multiple stab injuries. In this case, the diaphragm injury opening to the abdomen cavity is a role as pericardial window fortunately and that is a key point for surviving of the patient although major bleeding and relatively long transfer time.

## Analysis of Complications after a Cranioplasty with a Customized 3D Titanium-mesh Plate

Haewon Roh, Jong Hyun Kim, Taek-Hyun Kwon

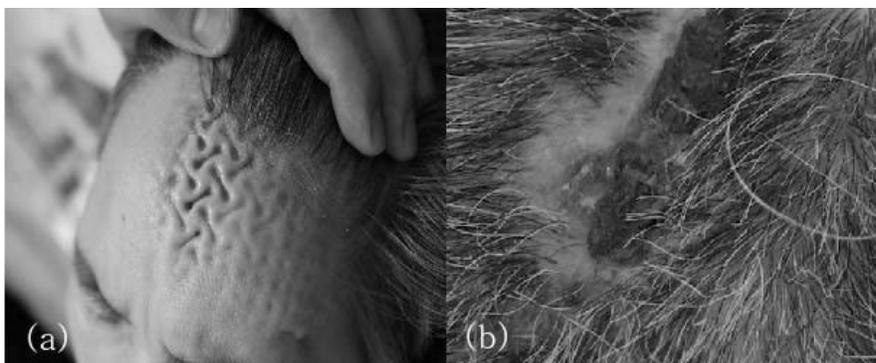
Korea University Guro Hospital

**Objective:** To report the outcomes of cranioplasty (CP) with a customized 3dimensional(3D) titanium-mesh plate and identify the relationship between various clinical variables and complications after CP.

**Methods:** A total of 20 patients who underwent decompressive craniotomy for traumatic brain injury and, after swollen brain was relieved, underwent cranioplasty using customized 3D titanium-mesh plates from January 2015 to December 2017 were enrolled. Complications related to CP were retrospectively reviewed. Patients were divided into two groups (no complication group and complication group), and various clinical variables related to complications were compared between the two groups. In addition, we performed the correlation analysis to identify the clinical variable significantly correlated with the complications after CP with a customized 3D titanium-mesh plate.

**Results:** Eleven out of 20 patients developed various complications, such as extrusion, intracranial infection, severe operation site pain, and wound dehiscence.(Figure 1) Among the various clinical variables, only the presence of ventriculo-peritoneal shunt (V-P shunt) system was significantly correlated with the overall complication (odds ratio, 14.00; p-value=0.032; 95% confidence interval 1.56-22.92).

**Conclusion:** While a customized 3D titanium-mesh plate is associated with a lower risk of intracranial infection, the rate of post-operative complications, including mainly cosmetic problems, such as forehead mesh extrusion and dehiscence, was high at 55%, and V-P shunt system was significantly correlated with the overall complication rate after CP with a customized 3D titanium-mesh plate.



## Sonographic Diagnosis of Biloma in Severe Traumatic Liver Injury

Chan Yong Park, Wu Seong Kang, So Ra Ahn, Sang Hyun Seo, Sung Nam Moon

Wonkwang University Hospital

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Biloma is a rare complication in patients with traumatic liver injury.

Biloma is usually confirmed by abdomen CT, and the first detection using abdominal ultrasound (US) is very rare.

We report a case of a patient with AAST OIS IV liver injury who performed transcatheter arterial embolization on the admission day and underwent percutaneous drainage after the diagnosis of biloma using US on the 5th day of admission.

In this case, biloma was observed as a hypo-anechoic fluid collection in the hepatic dome on US.

## Organs Donation after Trauma-related Brain Death in a Single Regional Trauma Center: 5 Year Experience

Dae Sung Ma, Sung Jin Kim, Seok Joo, Yang Bin Jeon, Sung Youl Hyun, Gil Jae Lee, Kang Kook Choi, Byungchul Yu, Junghnam Lee

Gil Medical Center, Gachon University College of Medicine, Incheon

**Objective:** The aim of this study was to describe the organ donation after trauma in a single institution.

**Methods:** We reviewed all trauma patients who donated organs from January 2014 to November 2018 in our regional trauma center. Classified of the donors according to traumatic lesion cause of brain death, and analyzed the difference of donated organs. Demographics, mechanism of injuries, hemodynamic parameters at arrive, and APACHE II score at ICU admission was collected based on EMR.

**Results:** A total of 21 traumatized patients became donors and solid organs of 71 were donated in the study period. The mean age of them,  $47.4 \pm 16.6$  years. Male was 85.7% (n=18/21). The traffic accident including occupant and pedestrian was the majority of injury mechanism. The mean of ISS was  $23.6 \pm 6.7$ . 28.6% (n=6/21) of patients were undergone surgical treatment of craniectomy due to significant brain injury. The mean days of the donation from trauma was  $9.0 \pm 6.0$  days. Compared with the non-surgical group, the surgical group was a shorter period until organ donation ( $10.3 \pm 6.5$  vs  $5.7 \pm 2.6$ ,  $p=0.030$ ). According to donated organs, the kidney was the most common (n=38/42, 90.5%), and then, the liver followed the second (n=15/21, 71.4%). The pancreas and lung were 4 (19%) and 5 (23.8%) respectively. A total of 20 organs were harvested including 3 hearts, 1 lung, 5 livers, 3 pancreas, and 8 kidneys in 5 patients undergone post-traumatic cardiac arrest.

**Conclusion:** Procurement of organs is a pursuable outcome after trauma-related brain death. Patients with irreversible brain injury including post-traumatic cardiac arrest might provide potential sources of solid organs donation.

## Hemipelvectomy after Common Iliac Vessel Injury: A Case Report

Yong Han Cha, Seung Ho Bang, Yun Su Mun, Dong Sub No, Seung Min Kim

Eulji University Hospital

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64-year old female visited trauma center directly from the accident scene. She was crushed on the lower abdomen and pelvic area by car. She was alert and her initial vital signs were as follows: Blood pressure 100/70mmHg, Heart rate 70/min, Respiratory rate 18/min, Body temperature 36.5°C. The patient complained of severe pelvic pain, and we immediately began wearing the pelvic binder and transfusing. Patient's blood pressure was elevated and CT evaluation was performed. The abdomen enhance CT image in the emergency room was not properly enhanced in the common iliac artery and the distal internal external iliac artery was not observed. Pelvic CT showed severe injury involving bilateral SI Joint and symphysis pubis. Emergency surgery was performed in consultation with the vascular surgeon. In the pelvis, all the blood vessels, nerves, and muscles were injured to the right SI joint and there was no connected structure. We tried to repair the injured artery, but failed due to bleeding and immediately underwent hemipelvectomy. In the pelvis, all the blood vessels, nerves, and muscles were injured to the right SI joint and there was no connected structure. Immediately after hemipelvectomy, her vital sign was stable. However, she expired on POD #2 due to multi-organ failure.

## Is High Grade Renal Injury (AAST grade V) a Predictor for Operation?

Chang Ho Jeon, Chang Won Kim, Hoon Kwon, Jae Hun Kim, Ho Hyun Kim, Sung Jin Park, Sang Bong Lee, Kwang Hee Yeo, Chan Ik Park, Gil Hwan Kim

Pusan National University Hospital

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The kidney is the third most common abdominal organ to be injured in trauma, following the spleen and liver, respectively. Major renal injuries are usually surgical emergencies. Current trend toward more conservative management of renal trauma, advances in interventional radiology in trauma field may increase the use of interventional procedures for renal injured patients.

Nonoperative managements of grade I-III injuries are widely accepted; however, management of grade IV and V injuries remains more controversial. In this study, we present the successful management cases with embolotherapy for extremely high grade renal injuries (AAST grade V).

## Delayed Translation Injury of C5/6 during Bed Rest at ICU

Jongtae Park, Eunsung Park

Wonkwang University Hospital

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**Objective:** 지연성의 경추 5/6번 골전전이 심해진 환자에 대해 보고하고자 한다.

**Methods:** 52세 남자 교통사고로 인한 경추부 골절 및 경수 손상으로 인한 사지 부전마비 상태에서 수술적치료 고려했으나 동반된 흉부 손상(혈흉)과 폐렴으로 수술이 불가능하여 보존적 치료하였음. 사고 1달후 중환자실에서 시행한 사진에서 경추5/6번에 심한 전이가 확인되어 수술적 치료를 시행함.

**Results:** 수술은 먼저 후방에서 4-5-6번의 후방고정과 감압후에 전방고정술을 시행하였다.

**Conclusion:** 경추 골절과 이로인한 불안정 척추상태에 있는 환자에서 비록 수술을 할 수 없는 경우 보존적치료를 하면서도 불안정척추로 인해 전이가 진행될 수 있으므로 이에 대한 주의가 필요하다.

## Delayed Superficial Femoral Artery Repair 12 Hrs Later after Ligation for Damage Control

Su Young Yoon, Hong Rye Kim, Jin Suk Lee, Seung Je Go, Young Hoon Sul, Jin Bong Ye, Jin Young Lee, Jung Hee Choi, Yook Kim, Jung Kwon Cha

Chungbuk University Hospital

**Case:** A 23-year-old man complained to his girlfriend. After stabbing his left thigh with a knife, the patient visited the emergency room through 119. There was no consciousness at the time of admission. The face was pale, bilateral pupil was dilated, L / R was absent, HR was 71 times, pulse was not palpable. The dressing site of thigh had some bleeding. HR was absent and CPR was performed in an arrest state. ROSC was briefly arrested and then ROSC was performed after CPR. Lt. Thigh pumping was resumed and the SBP fell below 60mmHg to perform the emergency op.- under general anesthesia, tourniquet banding was done on proximal thigh, pr. 200 mmHg. aseptic skin preparation was done. about 2cm extending incision was done upward and downward along stab wound. Vascular injury was small vein, and deep femoral vein, transection of artery, dia. 3-4mm: We could not distinguish artery from branch, deep femoral a. or superficial femoral a. We decided to perform reevaluation after damage control. The veins were ligated and primary sutured and transected artery was ligated. 12 hours later hospitalization, SBP 100 mmHg and HR 170 were measured and angiography for reevaluation was performed. Lt. superficial femoral a. distal flow was not found. (Fig. 1) Thrombectomy with Fogarty cath. and end to end anastomosis with ringed Gore-Tex 6 mm. was done. (Fig. 2) On the next day after admission, oliguria was performed and CRRT was performed. After 23 days, oliguria was improved. CPK was normalized 20 days after rising to 31080 after 2 days of hospitalization. Ventilator weaning was performed 15 days after admission. In about a month, the lesion was serous discharge (probably lymphatic discharge), and then it improved. At the time of discharge, there was no motor disturbance other than weak pain of the leg.

**Discussion:** Hemostasis and revascularization rely largely on damage control techniques and the use of temporary vascular shunts. In an ultra-emergency such as arrest, the anatomy can not be correctly interpreted because it is not evaluated. It is also possible to perform a definite surgery by stabilizing the vital sign with primary suture and reevaluating it.



Fig. 1. Angiogram.



Fig. 2. CT angiogram.

## Clinical Analysis of Trauma Deaths Who Died within Initial Resuscitation

Jin Bong Ye, Seung Je Go

Chungbuk National University Hospital

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**Objective:** All deaths should be reviewed for improving trauma patient care and practice and peer review of trauma death is critical component. Trauma program of advanced country widely included utilizing autopsy data.

autopsy of trauma death patient was not usually accepted and cause of early trauma death was presumed by only external exam of physician in Korea. The goal of this study was analyzing of early trauma deaths with trauma x-ray series, FAST, peer review and discussing about necessity of autopsy and post mortem CT scan.

**Methods:** This study is a retrospective review at Chungbuk regional trauma center. All early trauma death mortalities between January 2017 and December 2018 were identified using the institutional trauma registry. External cause of deaths with non-traumatic mechanisms (eg, drowning, suffocation) were excluded and uncertain cause of deaths were also excluded.

**Results:** There were a total 108 trauma death during 24 months. All cases were referred to the medical examiner and peer review. There were 76 men and 32 women. Average age was 51.5 years old. Mechanism of injuries consisted of motor vehicle accident, pedestrian trauma, fall down injury, stab wound and other injuries not encompassed by the other categories. Medical examiner estimated cause of death by using trauma x-ray series, laboratory finding, FAST finding and medical record. Trauma deaths who were unresponsive to initial resuscitation, may not have had enough time or stability to undergo complete trauma workups and diagnosis.

**Conclusion:** Peer review process allows for detection of missed injuries or malpractice that may be impacted trauma mortalities. There are not enough data to explain traumatic deaths cause. In some study, autopsy identified no preventable cause of deaths. But autopsy or post mortem CT scan may be useful to diagnosis of missed injury, and to identify protocol failure in maturing trauma systems.

## Delayed Rupture of Hepatic Pseudoaneurysm after Blunt Abdominal Trauma

Yunchul Park, Younggoun Jo

Chonnam National University Hospital

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**Background:** The incidence of hepatic pseudoaneurysm after abdominal trauma is rare but could result in critical consequences. Herein, we present a case of delayed rupture of hepatic pseudoaneurysm after blunt abdominal trauma.

**Methods:** A 46-year-old man referred to our hospital from outside clinic after blunt abdominal trauma. 7 days ago, she was hospitalized in the outside clinic after traffic accident due to grade IV liver laceration. At that time, she had undergone the angiography, and the extravasation of the contrast media did not exist. During the hospitalization period, the vital sign was stable, but the patient was transferred because of the continuous increases in bilirubin levels. On laboratory findings, hemoglobin was 11.1 g/dL, total/direct bilirubin was 12.5/10.0 mg/dL and AST/ALT was 190/339 U/L. Abdominal computed tomography(CT) showed a Slightly decreased extent of laceration injury and no evidence of biliary obstruction

**Results:** Patients were admitted to the intensive care unit and bilirubin levels tended to decrease. Two days after hospitalization, the patient's blood pressure was decreased with abdominal pain. Follow up abdomen CT showed active bleeding from pseudoaneurysm at the branch of right hepatic artery with the Increased amount of hemoperitoneum. Angioembolization was performed at the branch of right hepatic artery. 2 week later follow up CT showed no remarkable change of laceration of liver and loculated hematoma in the right hepatic lobe.

**Conclusion:** Liver injury has the potential for dangerous complications such as pseudoaneurysms. Careful attention is needed and early diagnosis with proper management lead to good prognosis when the patient state changes.

## Endoscopic Retrograde Pancreatic Drainage for Pancreas Head Injury after Surgery

Younggoun Jo, Min Gaegal, Yunchul Park, Jungchul Kim

Chonnam National University Hospital and Medical School

**Objective:** The diagnosis of pancreatic main duct injury is crucial in treating pancreatic head injury and the treatment approach is challenging. Here, we present a case of stent insertion for proximal pancreatic duct injury after damage control surgery.

**Methods:** A 44 year-old man was brought to emergency department after traffic accident. Initial Systolic blood pressure was 70 mmHg. An abdominal computed tomography (CT) showed hemoperitoneum with traumatic injury at pancreas head and duodenal 2nd portion. Multiple liver laceration and transverse colonic ischemic change was also noted. Immediate emergency operation was performed. On exploration, Pancreatic transection at head of pancreas was existed and duodenal wall contusion with ischemic change was found. Suture hemostasis at branch of superior mesenteric vein was performed. Due to perforation and ischemic change proximal colectomy was done. Owing to patient's physiologic status damage control surgery was conducted. 2 days later Second look operation was performed. Duodenal injury was improved and Ileocolic anastomosis was performed. Cholecystectomy was performed due to ischemic change of gallbladder. Closed suction drain was placed at pancreatic injury area.

**Results:** The patient's condition was slightly stable after the operation, but pancreatic fistula was formed and bilirubin level appeared to increase. Post operative day 5, total bilirubin and direct bilirubin was 8.98 mg/dL and 6.67 mg/dL. Follow up CT showed mild dilatation of biliary tree. After consulting to medical specialist Endoscopic Retrograde Cholangio-Pancreatography (ERCP) was performed. ERCP showed disconnected pancreatic duct and endoscopic biliary drainage and pancreatic stent insertion was performed. Follow up CT showed post operative change and improved injured site. 2 months later, patient was discharged and 3 months later internal stent was removed after follow up ERCP.

**Conclusion:** In the treatment of hemodynamic unstable pancreas head injury, after damage control surgery, evaluation of major pancreatic duct injury is necessary. Treatment through stent insertion could be attempted if endoscopic access is available.

## Triage of Severity of Patients in Emergency Department

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Young-Duck Cho<sup>2</sup>, Kyu-Hwan Ahn<sup>3</sup>, Se-Ha Lee<sup>4</sup>, Byung-Chul Ko<sup>5</sup>, Hye-Jung Pak<sup>6</sup>

<sup>1</sup>Bundang Jesaeng Hospital, <sup>2</sup>Korea University College of Medicine, <sup>3</sup>Bioinfra, <sup>4</sup>Korea University Medical Center,  
<sup>5</sup>Lotte Data Communication Center Company, <sup>6</sup>Korea University Guro Hospital

**Objective:** It is important to recognize of patients in the emergency department who need prompt treatment by visiting many patients simultaneously. Many countries use a variety of patient classification methods to identify severity, but they still have many problems. Therefore, we would like to find out the usefulness of a patient's severity assessment in a new way that gives appropriate values to the factors that can be obtained in the emergency department.

**Methods:** We collected a variety of factors that could be obtained from patients in the emergency department. In addition, by using approximately 600,000 data from the National health insurance service, the proper value was obtained for frequency using the Rash analysis method. Using the proper values of various factors, the cutoff value for determining the patient's admission and discharge was determined Accordingly, we evaluated the accuracy of the program as to whether the decision to be admitted and discharged from program is consistent with actual hospitalization and discharge in patients who are visiting the emergency department from 1 January to 31 December 2018

**Results:** In order to evaluate the severity at the early stages of patients' visits, the accuracy of the program was analyzed by a combination of factors that could be obtained in early stages of patient's visits among various factors. 22,782 patients registered for experiment, and when the cutoff value was set at 148, the sensitivity of hospitalization was 80% and positive predictive value of discharge from a hospital was 78%.

**Conclusion:** The initial severity evaluation of patients in the emergency department is very important for the medical staff, and this study was shown to be significant. With the use of more factors, accuracy will be improved. In addition, a combination of appropriate factors in certain diseases, such as severe trauma, will contribute a lot clinically.

## Spontaneously Resolved Lumbar Artery Injury after Blunt Trauma

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Hanyang University Guri Hospital, Hanyang University College of Medicine

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**Objective:** Major bleeding caused by vascular injury of abdominal aorta or its branch after blunt trauma often leads to mortality or major morbidity. We report a case that lumbar artery injury following blunt trauma was spontaneously resolved without any surgical or interventional treatment.

**Methods:** A 63-year old female visited our emergency room for blunt trauma caused by vehicle accident. On abdominal computed tomograms, large amount of hematoma adjacent to the infrarenal abdominal aorta with extravasation of contrast material was noted. Maintaining vital stability with fluid and blood transfusion, we urgently transferred her to the catheterization room to rule out and treat for vascular injury of the abdominal aorta or its branch.

**Results:** On diagnostic angiograms, extravasation of contrast material was not noted and the abdominal aortic wall seemed to be intact. We decided to treat her conservatively with serial image follow-up. On the 10th hospital day, decrement of the hematoma adjacent to the abdominal aorta was noted without any evidence of further active bleeding on the computed tomographic aortograms. She was discharged without any complication and followed up for three months.

**Conclusion:** Lumbar artery injury after blunt trauma could be treated conservatively without surgical or interventional treatment in a selected case. When an aortic or its branch injury was suspicious, diagnostic angiograms in the setting of interventional treatment may be helpful to decide an appropriate treatment modality.

## Significance of Macrophage Migration Inhibitory Factor for Sepsis in Hemorrhagic Shock Patients

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Hyung-Min Lee<sup>1</sup>, Bo-Sun Shim<sup>1</sup>, Sung-Wook Cho<sup>1</sup>, Hyun-Jin Kim<sup>1</sup>, Qiuyu Jiang<sup>2</sup>

<sup>1</sup>Korea University Guro Hospital, <sup>2</sup>Yanbian University of Science & Technology

**Objective:** Many patients die from sepsis and multiple organ failure, even though proper management in hemorrhagic shock patients. Early diagnosis of sepsis in hemorrhagic shock patients is important and used in various ways, such as CRP and WBC, procalcitonin (PCT), but they have some problems. Recently, macrophage migration inhibitory factor (MIF) have emerged as predictive factors. Our study aims to explore the significance of MIF as a predictor of sepsis in hemorrhagic shock patients.

**Methods:** This study was conducted on prospective observational study patients who visited an emergency medical center in a university hospital from March 1, 2018 to December 31, 2018 and were intended for hemorrhagic shock patients aged 15 or older. We measured WBC, CRP, PCT, MIF, TNF- $\alpha$ , Interleukin-6 (IL-6), and lactic acid with serum taken from the patient's blood. The definition of sepsis was defined as being part of SIRS criteria with infections within a week.

**Results:** 180 hemorrhagic shock patients were registered in emergency department, 28 of whom had sepsis within a week. The CRP, WBC, TNF- $\alpha$ , IL-6 did not differ in the comparison between sepsis and non-sepsis patients, while the PCT was somewhat high in sepsis patients ( $0.24 \pm 0.1 \text{ ng/mL} > 0.18 \pm 0.07 \text{ ng/mL}$ ), but with had no statistical significance. However, MIF was significantly elevated in sepsis ( $2633 \pm 710 \text{ pg/mL}$ ) to non-sepsis group ( $1460 \pm 680 \text{ pg/mL}$ ). There was no correlation between MIF and lactic acid, which is the diagnostic criteria of shock.

**Conclusion:** It is believed that MIF may be used as a measure of sepsis in hemorrhagic shock patients. However, more research on the occurrence of MIF is thought to be necessary.

## Secondary 3rd Lumbar Fracture with Scoliosis after Surgery of 1st Lumbar Bursting Fracture

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**Objective:** 요추1번의 골절에 대한 전후방고정술후에 1년후 특별한 외상 없이 발생한 요추3번과 측만증이 발생한 환자를 치료 후 보고하고자 한다.

**Methods:** 요추 1번 골절에 대한 전후방수술을 한 47세 남자가 수술후 1년만에 특별한 외상의 병력없이 요통이 심하게 발생하여 시행한 검사에서 3번의 골절과 측만증이 확인되었으며 점점 진행되는 양상을 보여 후방고정수술을 하였다.

**Results:** 수술후 환자의 통증은 사라지고 사진에서 측만은 다소 남아 있었지만 요추전만은 잘 유지하고 있다.

**Conclusion:** 요추 고정수술후에 그 주변부위에 외상없이 추가적 골절과 심한 측만 변형이 발생할 수 있으므로 골다공증이 심하거나 골절의 위험성이 심하다고 판단되는 환자에서 적절한 추적검사와 치료를 해야 한다.

## Mallet Deformity of Distal Phalanx of Index Finger after Snake Bite

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Soonchunhyang University Bucheon Hospital

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**Objective:** Snakebites are an uncommon but potentially serious cause of disability or death. Snakebites present as puncture wounds or scratches. Local symptoms may include pain, edema, erythema, or ecchymosis that may progress to skin necrosis or compartment syndrome.

**Methods:** A 48-year-old male patient was bitten by a snake on the distal dorsum of the left index while he was examining wild plants in the mountains. At first examination, this patient's injured finger was markedly swollen and red. While in the hospital for acute treatment, a blood blister was debrided. Patient presented one month later in our hospital with a skin necrotic change and hand x-ray demonstrating mallet deformity. He was taken to the operating room for further debridement and mallet finger of tendinous origin were treated using a modification of the internal suture technique.

**Results:** After he was discharged, wound dressing at out patient department was done twice and total healing state was diagnosed when postoperative day 21. Finger splint was applied at 6 weeks after operation.

**Conclusion:** We found a patient with delayed tendinosus mallet finger due to snakebite and confirmed to recover through appropriate diagnosis and one stage surgical treatment. Envenomation by snakebite can cause local tissue damage and important structure loss, so diagnosis and proper management in acute stage would be important.

## Clinical Effects of Intraabdominal Pressure in Critically Ill Trauma Patients

Dong-Yeon Ryu, Ho Hyun Kim, Chan-Kyu Lee, Kwang-Hee Yeo, Seon-Uoo Choi, Jae-Hun Kim, Hyun Min Cho

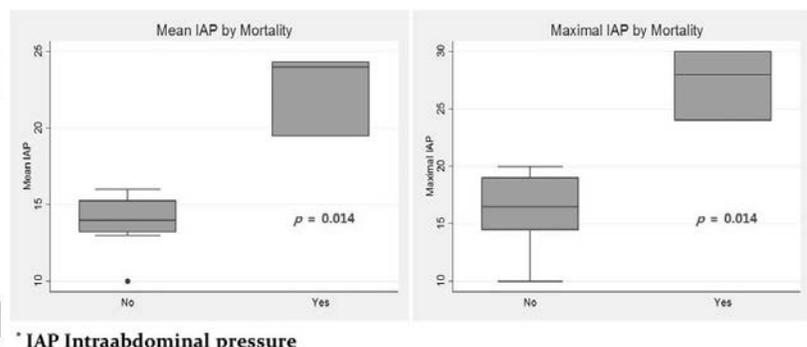
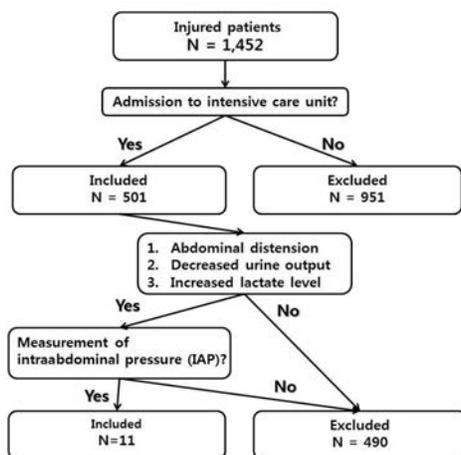
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**Objective:** There is increasing interest in intraabdominal pressure (IAP) and intraabdominal hypertension (IAH) in critically ill patients. This study investigated the effects and outcomes of elevated IAP in a trauma intensive care unit (ICU) population.

**Methods:** Eleven consecutive critically ill patients admitted to the trauma ICU at Pusan National University Hospital Regional Trauma Center were included in this study. IAP was measured every 8-2 h (intermittently) for 72 h. IAP was registered as mean and maximal values per day throughout the study period. IAH was defined as IAP  $\geq$  12 mmHg. Abdominal compartment syndrome was defined as IAP  $\geq$  20 mmHg plus  $\geq$  1 new organ failure. The main outcome measure was in-hospital mortality.

**Results:** According to maximal and mean IAP values, 10 (90.9%) of the patients developed IAH during the study period. The Sequential Organ Failure Assessment (SOFA) score was significantly higher in patients with IAP  $\geq$  20 mmHg than in those with IAP.

**Conclusion:** Our results suggest that an elevated IAP may be associated with a poor prognosis in critically ill trauma patients.



## Management of Severe Perineum Injury with Anal Sphincter and Urethral Injury

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Gacheon University Gil Hospital

**Objective:** Case report: perineum, bladder & urethra injury

**Results:** 26세 남자 환자로 2018년 12월 27일 오토바이 운전 중 사고로 수상. 회음부의 깊은 상처로 응급 수술 시행하였고 방광 파열, 요로 결손, 직장 손상 및 복강내 소장 장간막 및 장천공 소견 보임. 항문괄약근 손상 심하여 하트만 수술 시행하였고 방광 손상은 복강내로 접근하여 방광루 조성 후 봉합 하였음. 회음부 상처의 오염이 심하고 연부 조직 손상도 심하여 vacuum assisted dressing 시행하며 경과 관찰 중임.

**Conclusion:** 회음부의 연부조직 손상으로 방광 수술 부위가 외부로 노출된 상태이며 양측 신장의 PCN으로 소변이 배출되고 있는 상태이나 봉합한 부분의 요누출은 지속되고 있음. 그러나 vacuum assisted dressing으로 유출된 소변이 상처를 오염시키지 않고 빠져나가, 느리게 연부조직이 재생되고 있음. 현재 감염 소견없이 상처 회복 중임. 따라서 close suction system을 이용한 드레싱은 요누출이 있는 상처 치유에 도움을 줄 수 있다고 생각함.

## Traumatic Hemobilia Due to Gallbladder Injury

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Traumatic hemobilia due to gallbladder(GB) injury is rare clinical presentation.

The hemobilia in trauma patient is presented to gastrointestinal bleeding or bloody NG tube drainage with decreased hemoglobin.

In non-specific hemoperitoneum without hollow viscus injury, non perforated GB injury is difficult to be find.

The current abstract describe the case of a 69 year-old female patient presenting with bicycle trauma and post-traumatic abdominal pain. The physical examination of abdomen revealed tenderness but rigidity or guarding. A computed tomography scan revealed minimal fluid collection in abdominal cavity. A few hours later, blood pressure was hypotensive and bloody NG tube drainage was developed. Repeated computed tomography revealed abnormal distension of GB.

In hypotensive and bloody NG tube drainage, diagnosis of GB injury was determined. Emergency laparotomy was performed.

GB distension was detected. cholecystectomy was performed.

In specimen, internal mucosal and muscular layer laceration without perforation in GB was detected

After operation, the patient's operative course was aggravated. The patient was dead in post operative second day, because of multiple organ failure.

Traumatic GB injury with hemobilia without perforation is rare. The traumatic hemobilia need to be understood.

## Delayed Diagnosis of Traumatic Diaphragmatic Injury: A 22-Year Experience in a Single Trauma Center

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**Objective:** Diaphragmatic injury following blunt or penetrating trauma may be a missed diagnosis in an acute setting. The present study was designed to evaluate the pattern of traumatic diaphragmatic injury (TDI), incidence of associated injuries, clinical courses and predictors of delayed presentation of TDI.

**Methods:** We reviewed, retrospectively, the medical records of 76 patients who underwent diaphragmatic repair for diaphragmatic injury, including simple laceration or rupture, following blunt or penetrating trauma from 1995 to 2016.

**Results:** The mean age of the 20 patients at the delayed diagnosis was 49 years (range: 18-71 years). Male to female ratio was 9:1. Median duration between trauma and delayed diagnosis was 3 days (range: 1-744 days). Fourteen patients had left-sided diaphragmatic injuries. Diagnoses of diaphragmatic injury were confirmed in chest X-ray (N=5), computerized tomography (N=4), and incidentally during operation (N=11). Injury sites of the diaphragm were mostly lateral side (N=13). Thoracostomy for ipsilateral hemothorax was performed in 11 patients. Those patients were presented with massive hemothorax. Operative approaches were 17 thoracotomy and 3 laparotomy. Operative findings showed in 8 of the 20 patients that fractured rib segments caused diaphragmatic injuries. The independent predictors of delayed presentation of TDI were massive hemothorax ( $p=0.008$ ) and lower fractured rib segment penetrating diaphragm ( $p=0.047$ ). Mesh repair was utilized in one patient. The mean hospitalization time was 64.2 days (range: 8-387 days). There was one postoperative death.

**Conclusion:** A high clinical index of suspicion is needed to diagnose and effectively manage diaphragmatic injury. In severe multiple trauma patients, we should strongly suspect of TDI and never miss a chance to manage properly when dislocated rib segments of the lower chest with massive hemothorax would be proven with imaging modalities, such as CT or chest X-ray.

## Laparoscopic Peritoneum Repair for Stab Wound

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The practice of routine laparotomy for abdominal stab wounds has also been questioned because of high non-therapeutic operative rates (30~50%). Diagnostic laparoscopy (DL) carries a high diagnostic yield in the identification of intraabdominal injuries, and by exclusion of injuries, reduces the nontherapeutic laparotomy. DL can be used safely in hemodynamically stable patients and can be therapeutic in patients with selected injuries. In the isolated peritoneum injury without intraabdominal organ injury after stab injury on abdomen, repair of the injured peritoneum is needed, because of the risk of the incisional hernia. Extracorporeal peritoneum repair without the laparoscopic approach is usually performed with unnecessary extension of incision in case of small stab wound. Lacerated peritoneum can be intracorporeally repaired in the laparoscopic view without additional incision. Herein, I'd like to introduce several techniques of peritoneum repair in laparoscopic surgery, such as intracorporeal simple suture, V-Loc™ suture, and extracorporeal tie with suture passer.

## Damage Control Techniques for High-grade Liver Injury with Retrohepatic IVC Injury: Total Vascular Isolation of the Liver and Atriocaval Shunt

Dong Hun Kim, Seok Won Lee, Ye Rim Chang, Jeongseok Yun, Seokho Choi,  
Sung Wook Chang, Jung-Ho Yun

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High-grade liver injuries with the inferior vena cava (IVC) injury following blunt trauma have poor overall outcomes, which are one of the most difficult and challenging in abdominal vascular injuries managed by trauma surgeons. Most of patients with IVC injuries die from exsanguination after exploration of hematoma or free intraperitoneal rupture. Retrohepatic IVC injury carries the highest mortality rate, ranging up to 100%. Several surgical options for it have been reported, including use of the atriocaval shunt, endovascular repair, and total vascular isolation of liver. Especially, total vascular isolation of the liver and atriocaval shunt are unfamiliar to surgeons in Korea, but they may be necessary for any hope of survival. Herein, detailed procedures for total hepatic vascular isolation of liver and atriocaval shunt are introduced in animal labs and a clinical case that a 24-year-old man sustained blunt abdominal trauma from a crushing accident.

## Resuscitative Endovascular Balloon Occlusion of the Aorta: Ultrasound-guided Balloon Positioning

Dong Hun Kim, Sung Wook Chang

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Resuscitative endovascular balloon occlusion of the aorta (REBOA) as minimally invasive alternative to open aortic cross clamping to provide temporary aortic occlusion can be a bridging modality for damage control resuscitation. REBOA may be an effective resuscitative modality for temporary bleeding control in trauma patients with exsanguinating abdominopelvic hemorrhage. Zone I area, the level of aortic occlusion for REBOA, is the thoracic aorta below left subclavian artery for controlling abdominal hemorrhage and zone III is the infrarenal aorta for pelvic hemorrhage. Positioning of balloon catheter based on REBOA zone must be checked with imaging equipment, such as C-arm, sonography, or X-ray. Ogura et al. [1] reported that ultrasound-guided REBOA could determine the placement of the balloon catheter without fluoroscopy. However, transperitoneal sonographic windows may be poor in patients with pneumoperitoneum or subcutaneous emphysema, obesity, or fatty liver. And so, left upper quadrant ultrasound scanning through spleen or left kidney in the posterolateral aspect may be relatively useful for tracing the aortic pathway of the balloon catheter and be used to confirm zone I position, even though not suitable for zone III.

## Clinical Relevance of Abdominal Pelvic Computed Tomography Findings for Identifying Hollow Viscus Injury in Abdominal Trauma Patient

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**Objective:** Despite the development of more accurate computed tomography imaging, the diagnosis of traumatic hollow viscous injury (HVI) remains challenging. The aim of this study was to determine the accuracy of abdominal pelvic computed tomography scan (APCT) in diagnosing HVI in trauma patients.

**Methods:** A retrospective study of abdominal trauma patients who admitted to the Regional emergency medical center of between January 2008 and December 2018 was conducted. The study group included the patients who underwent an APCT and laparotomy within 24 hour of admission following trauma.

**Results:** Total number of the included patients was 156. There were 68 cases of penetrating trauma and 88 cases of blunt trauma. The sensitivity and specificity of APCT scan in predicting HVI of included total patients was 91.75% and 59.32%. And the positive and negative predictive values were 78.76% and 81.40% respectively. The sensitivity and specificity of APCT scan in predicting HVI of included penetrating patients was 87.50% and 50.00%. And the positive and negative predictive values were 80.77% and 62.50%. The sensitivity and specificity of APCT scan in predicting HVI of included blunt patients was 95.92% and 64.10%. And the positive and negative predictive values were 77.05% and 92.59%.

**Conclusion:** This study shows that diagnostic ability of APCT is not absolute in the HVI of the trauma patient. And the sensitivity and specificity of the APCT showed that the penetrating trauma patient was lower than the blunt trauma patient.

## Resuscitative Endovascular Balloon Occlusion of the Aorta: A Single Trauma Center Experience in Korea

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Sung Wook Chang, Jung-Ho Yun

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**Objective:** Resuscitative endovascular balloon occlusion of the aorta (REBOA) as minimally invasive alternative to open aortic cross clamping to provide temporary aortic occlusion can be a bridging modality for damage control resuscitation. We present experiences of REBOA in patients with noncompressible torso hemorrhage after multiple blunt trauma in Korea.

**Methods:** A prospective data of trauma patients undergoing REBOA at a level I trauma center from 2016 to 2019 was analyzed retrospectively. The inclusion criteria were blunt trauma patients with abdominopelvic exsanguination and hypotensive hemodynamics.

**Results:** Of 37 blunt trauma patients underwent REBOA, 31 who had abdominopelvic hemorrhage were eligible for the selection criteria. The median age of REBOA patients was 54 years (interquartile range, 43-66), and 77.4% were male. The median injury severity score was 30 (25-43). Aorta was occluded in zone I of 21 patients (67.7%) with abdominal organ injuries and zone III of 10 (32.3%) with unstable pelvic fracture. Ten patients (32.3%) survived with damage control procedure following REBOA (7 zone I, 3 zone III). The median systolic blood pressure (SBP) of 97 mmHg (89-108) after REBOA was significantly higher than SBP of 55 mmHg (46-60) before ( $p < 0.001$ ). In the survivor group of REBOA, as compared with the nonsurvivor, there were significant higher rates of hemorrhage of a single abdominal organ except liver (60.0% vs. 9.5%,  $p = 0.006$ ), high Glasgow Coma Scale (15 [9-15] vs. 6 [3-11],  $p = 0.002$ ), low requirement of RBC transfusion (14 [11-18] vs. 34 [22-48] units,  $p < 0.001$ ), and short aortic occlusion time (72 [39-122] vs. 187 [59-480] minutes,  $p = 0.009$ ).

**Conclusion:** REBOA might be a favorable resuscitative modality, especially for traumatic exsanguination of a solitary abdominal organ except liver. Systemic treatment strategies for definitive bleeding control of multiple abdominopelvic injuries would be needed for survival following REBOA.

## 외상 중환자실 간호사의 교육 현황 및 교육 요구도 조사: 권역 외상센터 외상중환자실 간호사를 대상으로

Kyoungmi Kim

Dankook University Hospital

**Objective:** 외상 중환자실 실무에서 수행되는 간호업무에 대한 교육 요구 항목을 지식, 술기, 태도로 나누어 중요도와 수행도, 난이도, 교육 요구도를 파악하여 외상 중환자 간호업무에서 우선 순위로 필요로 되는 교육 요구도를 확인하고 중환자실 간호사의 간호업무 수행능력을 향상시킬 수 있는 실무중심의 교육프로그램 개발이다.

**Method:** 대상은 전국 권역외상센터 중 5개의 외상중환자실에 근무하는 간호사 123명을 대상으로 자가 보고형 설문지를 사용하여 지식, 술기, 태도에 대한 중요도, 수행도, 난이도, 교육 교육도 35항목 수집된 자료는 SPSS 22.0 통계 패키지 프로그램을 이용하여 분석하였다.

**Results:** 국내 외상환자 교육에 참여한 경험에 대해 '예' 78.9%(97명), '아니오' 21.1%(26명)으로 나타내며, 참여한 응답자 중 참여한 교육과정에 대해서는 '보수 교육 외상 응급환자 간호, 외상환자 간호'의 항목이 가장 많았으며 국외 외상간호교육 경험에 대해서는 '아니오'가 95.9%(118명), '예' 4.1%(5명)으로 나타났다. 원내 외상중환자실 간호사를 위한 교육의 경험 여부에 대해서는 '예' 52.0%(64명), '아니오' 48.0%(59명)으로 나타났다. 지식, 술기, 태도에 대해 중요도, 수행도, 난이도, 교육 요구 항목에 대한 분석 결과 지식의 경우 중요도(M=3.52), 교육 요구도(M=3.18), 수행도(M=3.15), 난이도(M=3.14)의 순으로 평균값이 나타났으며, 술기의 경우 중요도(M=3.47), 수행도(M=3.12), 교육 요구도(M=2.97), 난이도(M=2.85)의 순으로 나타났으며, 태도의 경우 중요도(M=3.64), 난이도(M=3.13), 수행도(M=3.12), 요구도(M=3.05)의 순으로 나타났다.

**Conclusion:** 교육 현황을 파악할 수 있었으며 필요로 하는 교육에 대한 항목을 알 수 있었다. 또한 외상 간호사의 지식, 술기, 태도에 대한 중요도, 수행도, 난이도, 요구도의 분석 결과 태도가 지식과 술기보다 중요한 것으로 나타났으나, 실제 현장에서 근무하는 실무자인 만큼 지식과 술기에 대한 중요도 인식이 필요한 것을 알 수 있었으며, 수행도의 경우 지식, 술기, 태도 항목이 모두 비슷하게 수행되고 있음을 확인 난이도의 경우 술기가 제일 쉬운 것으로 나타났으며, 교육 요구도의 경우 지식이 제일 높게 나타났다. 태도, 술기의 순으로 나타난 것을 확인하였다. 최근의 의료 환경 변화는 간호사의 역할 변화와 확장, 제공되는 간호의 질적 향상, 그리고 높은 지식과 기술 수준을 요구하고 있기 때문에, 지식, 술기, 태도에 대한 중요도, 수행도, 난이도, 요구도는 지속적인 새로운 습득의 필요성을 강조하는 것으로 볼 수 있다. 효율적인 교육방법이 필요성과 경력별 체계적인 지식, 술기, 태도에 관한 교육 프로그램 및 교육방법 개발이 필요한 것을 볼 수 있다.

## Blunt Traumatic Injury of the Portal Vein Managed by a Goretex Prosthetic Graft: The Role of Cooperation of Multiple Trauma General Surgeon Team

Sung Jeep Kim, Ji-Hoon Kim, Kuhyuk Kyeung, Min Eh Kum, Sung Ho Choi, Sung Kun Park

Ulsan University hospital

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**Objective:** the role of cooperation of multiple trauma general surgeon team for preparing operation of very difficult and complicated traumatic abdominal surgeries.

**Methods:** We had a case of massive blunt traumatic injury of the portal vein managed by a gortex prosthetic graft. The patient was a 24-year-old women injured by pedestrian traffic accident.

**Results:** We had a case of massive blunt traumatic injury of the portal vein managed by a gortex prosthetic graft. The patient was a 24-year-old women injured by pedestrian traffic accident. She had a 3cm-length portal vein crushed, transected injury, grade IV liver injury, distal common bile duct injury, duodenal perforation with severe retroperitoneal inflammation, pancreatic head injury, multiple rib fracture with hemo-pneumothrorax and right clavicle fracture. ISS was 38 and she had 4 times laparotomies including the portal vein repair with a 10 mm gortex prosthetic graf, CBD resectin with choledochojejunostomy, pyloric exclusion with GJ-stomy, duodenal primary repair with duodensotomy, JJ-stomy, and ect. performed successfully by multiple subspeciality-trauma surgeon team (3 trauma general surgeons who had a upper gastrointestinal, a hepatobilliary and a vascular subspeciality) and is well recovering and managed in general ward.

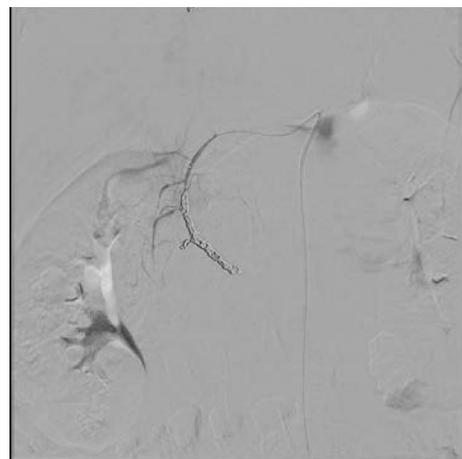
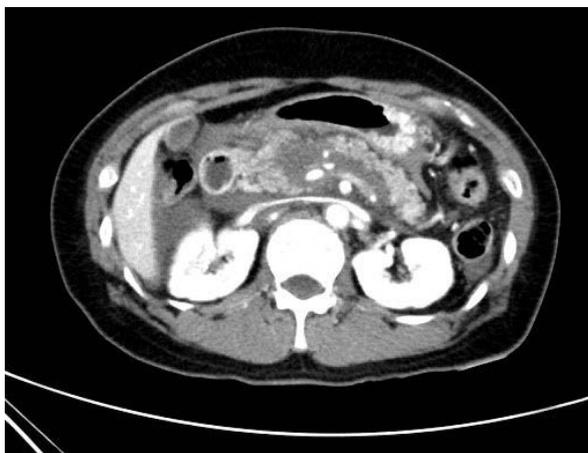
**Conclusion:** severe trauma patients who need very difficult and complicated traumatic abdominal surgeries just like as a severe portal vein injury can be managed successfully by the cooperation of multiple subseciality trauma surgeon team.

## Role of Angiographic Embolization in Severe Pancreas Injury

Sanghyun Seo, Sunnam Moon

Radiology

A 43-year-old woman visited the emergency room after car accident. Initial BP was 75/58 mmHg. Computed tomography (CT) showed AAST grade 4 pancreatic injury with multiple active bleeding. In addition, AAST grade 3 liver injury was accompanied. As the operation room was not ready to immediate emergent operation, and we decided to perform endovascular treatment to prevent further bleeding. Celiac angiography showed extravasation in the left hepatic artery, embolization was performed. Followed gastroduodenal artery angiography showed a cut-off sign with extravasation. The gastroduodenal artery embolization with coil was done. As there was a request of a surgeon, additional pre-operative splenic embolization was performed. After the endovascular intervention procedure, the BP was recovered to 96/67 and the total treatment time was about 45 minutes. After 30 minutes, the operation room was ready, subtotal pancreatectomy with splenectomy was performed. The surgeon reported that bleeding was scarcely visible and that good vision was obtained, and the operation was much easier to accomplish the successful outcome. Pancreatic injuries are relatively rare in trauma patients, but it is an important factor to predict prognosis of the trauma patients. In hemodynamically unstable patients, surgical treatment is the treatment of choice. It is known that angiographic embolization has a limited role in pancreatic injuries. This case shows the possibility of angiographic embolization as pre-operative hemostasis in severe traumatic pancreas injury patients. If the interventional radiologist is always available for emergent cases, we expect that angiographic embolization can be an important measure for the preoperative procedure.



## Endovascular Treatment of Post-traumatic Adrenal Hemorrhage: Case Series and Review of the Literature

Hyunseok Jung

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Adrenal hemorrhage following blunt trauma is a rare occurrence. The wide variation in clinical manifestations and lack of specific biologic markers make its diagnosis difficult. Computed tomography (CT) remains the golden standard for detecting this injury. The presence of adrenal hemorrhage in a patient with trauma is associated with higher injury severity, and coexisting injury to the liver, ribs, kidneys, or spleen is common. Post-traumatic adrenal hemorrhage is potentially devastating if unrecognized during the treatment of trauma patients. Because of the adrenal glands' rich vascularity, they often hemorrhage upon traumatic impact. However, there has been no conclusion about the indications for intervention in cases of post-traumatic adrenal hemorrhage. In this article, case series of embolization for post-traumatic adrenal hemorrhage are described. In addition to cases report, a literature review of endovascular treatment for post-traumatic adrenal hemorrhage is presented.

## Introduction of Korean Trauma Intervention Registry

Chang Ho Jeon<sup>1</sup>, Chang Won Kim<sup>1,2</sup>

<sup>1</sup>Pusan National University Hospital, <sup>2</sup>Korean Intervention Society for Trauma

**Objective:** 외상환자의 치료에 있어 인터벤션의 필요성은 증가하고 있으나 다학제적 진료환경인 외상센터에서 인터벤션 전문의의 역할과 지위는 아직까지 확정적이지 못한 바 크다. 중증외상환자의 치료에 있어 인터벤션의 현재의 역할과 위치를 파악하는 것은 보다 효과적인 외상환자 치료의 체계를 완성하는데 있어 필수적으로 여겨진다. 한국외상인터벤션 등록 자료를 토대로 외상센터에서의 인터벤션의 위상을 알리고 외상의 치료적 영역에 기여하고자 한다.

**Methods and Results:** 외상인터벤션의 역할에 대해 조사하고 치료 결과에 대한 표준화된 자료의 구축을 위한 회의를 진행하였다. 2018.9부터 웹 기반으로 전국 외상센터의 외상 인터벤션 기술을 데이터베이스화 하여, 한국외상인터벤션 등록사업(Korea Trauma Intervention Registry, <http://trauma.re.kr:5000>) 체계를 구축, 시작하였다.

**Conclusion:** 한국외상인터벤션 레지스트리 사업을 시작함을 계기로 외상 영역에서의 다학제적 진료의 발전에 이바지하고자 한다.

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