

***"WIND OF CHANGE"***

**PPTC 2018**

**6<sup>th</sup> Pan-Pacific Trauma Congress**

Mar 29 (Thu.) - 31 (Sat.), 2018

Busan Port International Exhibition & Convention Center, Busan, Korea



**PPTC 2018**  
6<sup>th</sup> Pan-Pacific Trauma Congress

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## Welcome Message

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As a Chairman of the board of directors of Korea Society of Traumatology, I deeply appreciate all the participants joining this 6<sup>th</sup> Pan-Pacific Trauma Congress to be held in Busan, Korea, from 29 to 31 March 2018.

For the last few years, we have put our whole effort in establishing a high-level trauma system, good trauma education program, and a good co-operation system between civil and military trauma division, and I appreciate all the efforts made by the members of our society.

However, there are still a lot of problems to be solved, which can affect not only the independence of trauma system, but also the identity of trauma surgeons. And I truly believe that these problems can only be solved by the discussion and co-operation between us.

Thus, we are gathered here to make a better understanding of each other, and to set a higher standard of treatment for our patients. And these efforts will surely result in higher chance of survival in our patients, and eventually, better performance of our trauma centers. Also, we will find the best way to reduce the incidence of trauma, which will improve the overall performance of Korea.

I am convinced that this meeting will make a great success, and I hope all of you to enjoy this meeting.

Best regards,

**Hyun Min Cho**  
Chairman, Board of Directors  
Korean Society of Traumatology

**PPTC 2018**  
6<sup>th</sup> Pan-Pacific Trauma Congress

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## Welcome Message

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It is a great pleasure for me to co-host the 6<sup>th</sup> Pan-Pacific Trauma Conference with the Korean Society of Traumatology and to invite trauma experts in the Pan-Pacific region.

Armed Forces Medical Command, under close collaboration with the Korean Society of Traumatology, has been putting its utmost effort in enhancing the trauma-treating capabilities by co-hosting the combined symposium and Pan-Pacific Trauma Conference. As a result, we have newly established the Medical Air Evacuation Corps for the rapid evacuation of emergency patients and trauma patients, opened the Medical Emergency Operation Center which fulfilled the system of making prompt and timely decisions and measures regarding the on-site emergency treatment/evacuation and decisions made at the medical facilities.

Currently, the globe has confronted with diverse threats including numerous terrorisms and mass disasters. In particular, the Pan-Pacific region is faced with frequent natural disasters such as earthquake, volcano eruption and typhoons. Also, not only numerous terrorist threats are existence to us, but the size of such threats surpass the capacity of sole institution which all makes the flexible and active collaboration among relative institutions inevitable and also for the safety of citizens and the country, it is highly desirable.

In this point of view, I believe it will be a great opportunity to reinforce the mutual collaboration system that achieves the common goals. Particularly, as this year's conference is attended by not only experts in the Pan-Pacific region but also by experts of traumatology from outside the Pan-Pacific region to broaden the academic exchange, it will be a beneficial occasion for all and I am expecting it to play a great role in both military medicine and the development of military medicine.

**BG Jong Seong Ahn**

Commanding General

R.O.K. Armed Forces Medical Command

# Organization

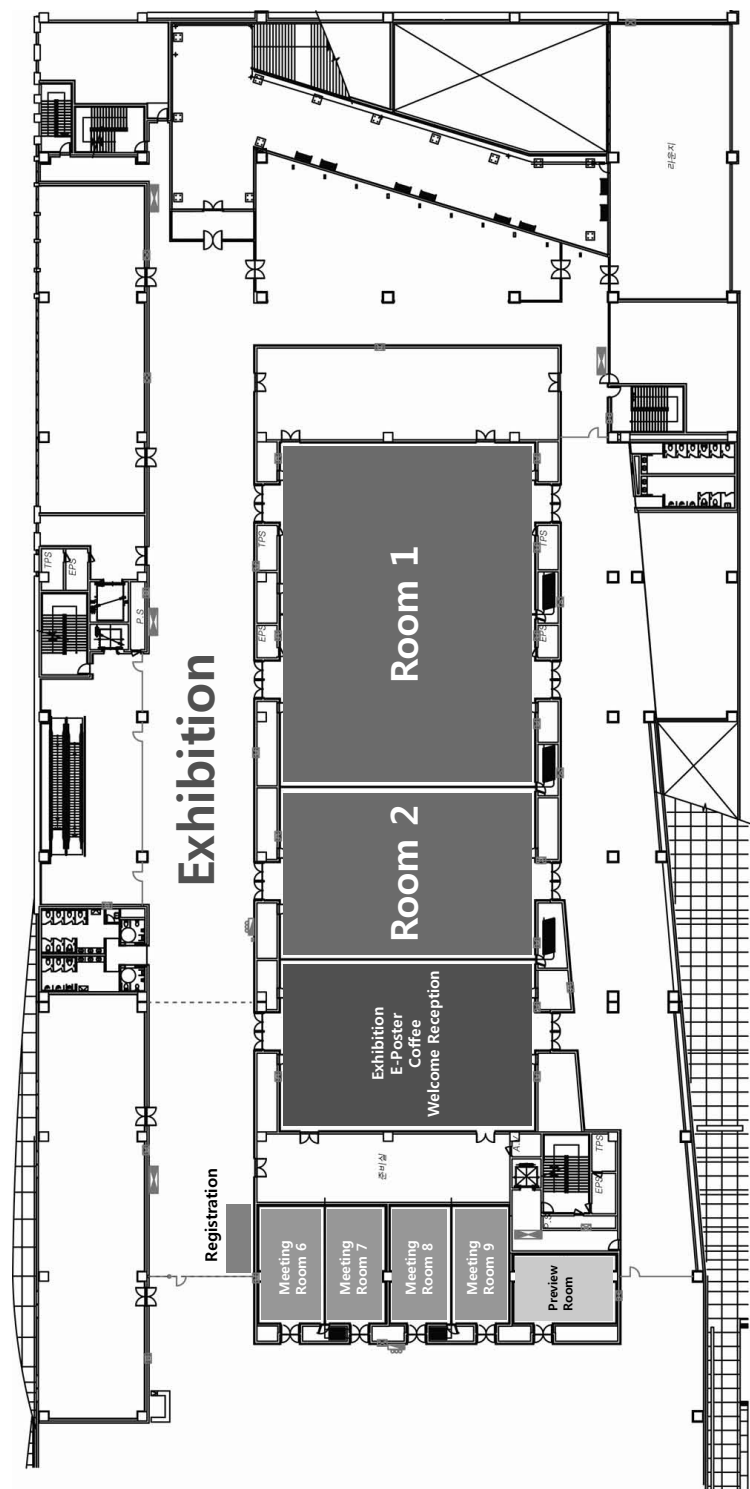
## Korean Society of Traumatology (KST)

President	Kang Hyun Lee (Yonsei University Wonju College of Medicine)
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)
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Director of Public Relations Committee	Namryeol Kim (Korea University, Korea)

## Armed Forces Medical Command (AFMC)

Co-President	BG Jong-Seong Ahn
Advisor	BG Woong Seok
Secretary General	COL Ji-Weon Seo
Secretary	LTC Jung Won Choi Mrs Mi Kyung Kim MAJ Dong Hoon Kim

## Floor Plan



# Program

 Friday 30 March 2018

TIME	Room 1	Room 2
08:20-08:45	Registration	
08:45-09:00	<b>Opening Ceremony</b> **Emceed by Kyung Hag Lee (National Medical Center, Korea)	
	08:45-08:50 Opening Address Hyun Min Cho (Chairman, Board of Directors of KST)	
	08:50-08:55 Congratulatory Address Kang Hyun Lee (President of KST)	
	08:55-09:00 Congratulatory Address BG Jong-Seong Ahn (Commanding General of Armed Forces Medical Command, Korea)	
09:00-10:00	<b>Oral Session 1: Trauma Care</b>	<b>Paramedic Education</b>
	Session Director: Woo Jin Jung (Yonsei University Wonju College of Medicine, Korea)	Session Director: Jundong Moon (Kongju National University, Korea)
	Moderator: Seok Ho Choi (Dankook University, Korea) Seung Hwan Pyun (Armed Forces Yangju Hospital, Korea)	Moderator: Hyun Ho Ryu (Chonnam National University, Korea) Hyun Wook Ryoo (Kyungpook National University, Korea)
	09:00-09:15 Trauma Team Activation Criteria: Full Trauma Team Activation or Modified Trauma Team Activation? Seok Ran Yeom (Pusan National University, Korea)	09:00-09:20 Essential Psychomotor and Cognitive Skills in for Prehospital Trauma Education Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)
	09:15-10:00 Oral Presentation (OP1)	09:20-09:40 Making Effective Trauma Scenario for High-Fidelity Simulation Jundong Moon (Kongju National University, Korea)
		09:40-10:00 Critical Skill Station Using Animal Model Chan Yong Park (Wonkwang University, Korea)
10:00-11:00	<b>Plenary Session 1</b>	
	Session Director: Bo-Ra Seo (Mokpo Hankook Hospital, Korea)	
	Moderator: Keum Seok Bae (Yonsei University Wonju College of Medicine, Korea) Byung Moon Cho (Hallym University, Korea)	
	10:00-10:30 Trauma System in Taiwan Li-Chien Chien (Taipei City Hospital, Taiwan)	
	10:30-11:00 Moderate and Severe Traumatic Brain injury: Monitoring and Targeted Management for Neuroprotection Kwang wook Jo (The Catholic University of Korea, Korea)	
11:00-11:30	Coffee Break	
11:30-12:30	<b>Plenary Session 2</b>	<b>Oral Session 2: Nutrition</b>
	Session Director: Chan Yong Park (Wonkwang University, Korea)	Session Director: Gil Jae Lee (Gachon University, Korea)
	Moderator: Ho-Seong Han (Seoul National University, Korea) Jong-Seong Ahn (Armed Forces Medical Command, Korea)	Moderator: Dong Woo Shin (Hallym University, Korea) Do Joong Park (Seoul National University, Korea)
	11:30-12:00 What is the Next Mission for Trauma Care System in Korea? Kang Hyun Lee (Yonsei University Wonju College of Medicine, Korea)	11:30-11:50 Energy and Protein Requirement in Severe Trauma Patients Chi-Min Park (Sungkyunkwan University, Korea)
	12:00-12:30 Directions of Military Trauma System Innovation (What Should We Focused on Military Trauma System Innovation?) Byung Seop Choi (Army Headquarters, Korea)	11:50-12:10 Nutritional Support in TBI Patients Bo-Ra Seo (Mokpo Hankook Hospital, Korea)
		12:10-12:30 Oral Presentation (OP2)

 Friday 30 March 2018

12:30-13:30	Luncheon Seminar 1	
	Session Director: Chan Yong Park (Wonkwang University, Korea)	
	Moderator: Jae Gil Lee (Yonsei University, Korea)	
	12:30-13:00 Clinical Role of Moxifloxacin in cIAI and cSSSI <i>Ja-cob Lee (Hallym University, Korea)</i>	
13:30-14:30	Special Lecture Session 1: Future of Trauma in Korea	
	Session Director: Chan Yong Park (Wonkwang University, Korea)	Management of Pediatric Unstable Pelvic Ring Injury: Panel Discussion
	Moderator: Hun Joo Kim (Wonju Medical Center, Korea) Kang Hyun Lee (Yonsei University Wonju College of Medicine, Korea)	Session Director: Kyung Hag Lee (National Medical Center, Korea)
	13:30-13:50 Developmental Planning of Korea Trauma Center <i>Hyun Min Cho (Pusan National University, Korea)</i>	13:30-14:30 Management of Pediatric Unstable Pelvic Ring Injury <i>Jae-Woo Cho (Korea University, Korea)</i>
	13:50-14:10 Plan of KTDB Utilization <i>Han Deok Yoon (National Emergency Medical Center, Korea)</i>	Panelist: Jong-Keon Oh (Korea University, Korea) Min Bom Kim (Seoul National University, Korea) Kyung Jin Oh (Chonnam National University, Korea) Oh Sang Kwon (Cheju Halla General Hospital, Korea)
	14:10-14:30 Discussion	
14:30-15:30	Oral Session 3: Infection	
	Session Director: Ye Rim Chang (Dankook University, Korea)	Current Guidelines for Severe TBI
	Moderator: Chi-Min Park (Sungkyunkwan University, Korea) Suk-Kyung Hong (University of Ulsan, Korea)	Session Director: Bo-Ra Seo (Mokpo Hankook Hospital, Korea)
	14:30-14:45 Appropriate Choice and Duration of Antibiotics for Trauma Patients <i>Kye-Hyung Kim (Pusan National University, Korea)</i>	14:30-14:50 Treatment <i>Namkyu You (Ajou University, Korea)</i>
	14:45-15:30 Oral Presentation (OP3)	14:50-15:10 Monitoring and Thresholds <i>Tae Kyoo Lim (Gachon University, Korea)</i>
		15:10-15:30 Discussion
15:30-16:00	Coffee Break	
16:00-17:00	Oral Session 4: Intervention	
	Session Director: Chang Ho Jeon (Pusan National University, Korea)	Nurses in Trauma Field
	Moderator: Chang Won Kim (Pusan National University, Korea) Gil Joon Suh (Seoul National University, Korea)	Session Director: Byungchul Yu (Gachon University, Korea)
	16:00-16:15 Current Status and Future Direction of Interventional Radiology on Trauma: Focus on Korean Regional Trauma Centers <i>Chang Won Kim (Pusan National University, Korea)</i>	16:00-16:15 Is It Special? Nurses in the Trauma Field <i>Byungchul Yu (Gachon University, Korea)</i>
	16:15-17:00 Oral Presentation (OP4)	16:15-16:30 Trauma Quality Improvement <i>Suji Kim (Pusan National University, Korea)</i>
		16:30-16:45 Trauma Resuscitation and Intensive Care Unit Nursing <i>Kyoung Mi Kim (Dankook University, Korea)</i>
17:00-18:00	Oral Session 5: Resuscitation	
	Session Director: Sun Hee Kim (Pusan National University, Korea)	Oral Session 6: Research
	Moderator: Young Rock Ha (Bundang Jesaeng General Hospital, Korea) Seog-Ki Lee (Chosun University, Korea)	Session Director: Oh Hyun Kim (Yonsei University Wonju College of Medicine, Korea)
	17:00-17:15 Recent Updates of Damage Control Resuscitation <i>Jae Hun Kim (Pusan National University, Korea)</i>	17:00-17:15 Cell Study Approach in Hemorrhagic Shock Model <i>Sung Hyuk Choi (Korea University, Korea)</i>
	17:15-17:30 Perioperative Intravascular Volume Resuscitation in Trauma Patient: Anesthesiologist's Perspective <i>Tae Yop Kim (Konkuk University, Korea)</i>	17:15-18:00 Oral Presentation (OP6)
	17:30-18:00 Oral Presentation (OP5)	

 Saturday 31 March 2018

TIME	Room 1	Room 2
08:00-09:00	<b>Mini Oral Presentation 1 (MINI-OP1)</b> Moderator: Kun Hwang (Inha University, Korea) Ji Hoon Kim (University of Ulsan, Korea)	<b>Mini Oral Presentation 2 (MINI-OP2)</b> Moderator: Yong-Cheol Yoon (Gachon University, Korea) Jung-Ho Yun (Dankook University, Korea)
09:00-10:00	<b>International Symposium 1: Disaster (Language: English)</b>	<b>Trauma QI</b>
	Session Director: Nam Ryeol Kim (Korea University, Korea)	Session Director: Sung Wook Chang (Dankook University, Korea)
	Moderator: Eun Seok Hong (University of Ulsan, Korea) Chae Hyuk Lee (Armed Forces Goyang Hospital, Korea)	Moderator: Seong Keun Moon (Wonkwang University, Korea) Min Koo Lee (Cheju Halla General Hospital, Korea)
	09:00-09:40 Global Surgery <i>Tarek Razeq (McGill University, Canada)</i> 09:40-10:00 Advanced Technology in Humanitarian Aid <i>Nam Ryeol Kim (Korea University, Korea)</i>	09:00-10:00 <b>Quality Improvement Program in Trauma Center</b> Simple Modification of Trauma Team Activation Criteria <i>Jungwon Lee (Dankook University Hospital, Korea)</i> Simplification of Official Procedures to Reduce ED Stay <i>Ae Lee Hong (Ulsan University Hospital, Korea)</i> Shortening the Final Decision Time for Severe Trauma Patients <i>Bo-Ra Seo (Mokpo Hankook Hospital, Korea)</i> Trauma Resuscitation in a Trauma Bay: What to Do? <i>Yo Huh (Ajou University School of Medicine, Korea)</i> Activities to Reduce the Hospital Transfer Rate by Controlling Inappropriate Cases of Transfers of Severe Trauma Patients <i>Suji Kim (Pusan University Hospital, Korea)</i> Quality Management and Improvement on KTDB <i>Jeong Eun Im (Gachon University Gil Medical Center, Korea)</i> Quality Improvement Plan <i>Seongyup Kim (Wonju Severance Christian Hospital, Korea)</i>
10:00-11:00	<b>International Symposium 2: MTP (Language: English)</b>	<b>Trauma Video Session 1: Specific Procedures in Trauma</b>
	Session Director: Chan Yong Park (Wonkwang University, Korea)	Session Director: Dong Hun Kim (Dankook University, Korea)
	Moderator: Ho-Seong Han (Seoul National University, Korea) John Cook-Jong Lee (Ajou University, Korea)	Moderator: Hyo Yoon Kim (Andong Hospital, Korea), Kyu-Hyounk Kyoun (University of Ulsan, Korea)
	10:00-10:30 MTP in Japan <i>Yosuke Matsumura (Chiba University, Japan)</i> 10:30-11:00 MTP in Korea <i>Sejong Chun (Chonnam National University, Korea)</i>	10:00-10:20 Bedside Procedure <i>Dae Sang Lee (The Catholic University of Korea, Korea)</i> 10:20-10:40 Bedside US-guided PCC Insertion <i>Eunmi Gil (Sungkyunkwan University, Korea)</i> 10:40-11:00 Bedside Percutaneous Dilatational Tracheostomy <i>Dae Sung Ma (Gachon University, Korea)</i>
11:00-11:30	Coffee Break	
11:30-12:30	<b>International Symposium 3: Hybrid ER/OR (Language: English)</b>	<b>Trauma Video Session 2: Trauma Surgery</b>
	Session Director: Chan Yong Park (Wonkwang University, Korea)	Session Director: Dong Hun Kim (Dankook University, Korea)
	Moderator: Jae Baek Lee (Chonbuk National University, Korea) Hyun Min Cho (Pusan National University, Korea)	Moderator: Jung Joo Hwang (Eulji University, Korea) Jung Chul Kim (Chonnam National University, Korea)
	11:30-12:00 Development of the Hybrid ER System in Japan: Now is the Time to Spread It Across the Entire Asia <i>Takahiro Kinoshita (Osaka General Medical Center, Japan)</i> 12:00-12:30 Hybrid OR in a Trauma Center of Korea <i>Ji Young Jang (Yonsei University Wonju College of Medicine, Korea)</i>	11:30-11:50 Trauma Surgery of Abdomen <i>Seung Je Go (Chungbuk National University, Korea)</i> 11:50-12:10 Organ Specific Tips in Trauma Laparoscopy <i>Hangjoo Cho (The Catholic University of Korea, Korea)</i> 12:10-12:30 Specific Bleeding Control in Damage Control Surgery <i>Dong Hun Kim (Dankook University, Korea)</i>

 Saturday 31 March 2018

12:30-13:30	Luncheon Seminar 2	
	Session Director: Chan Yong Park (Wonkwang University, Korea)	
	Moderator: Jinyoung Park (Kyungpook National University, Korea)	
	12:30-13:00 Disseminated Intravascular Coagulation in Trauma <i>Hangjoo Cho (The Catholic University of Korea, Korea)</i>	
13:30-14:30	Special Lecture Session 2: System	
	Session Director: Chan Yong Park (Wonkwang University, Korea)	Debate Session: Multidisciplinary Collaboration
	Moderator: Sung Hyuk Choi (Korea University, Korea) Sang Do Shin (Seoul National University, Korea)	Session Director: Chang Ho Jeon (Pusan National University, Korea)
	13:30-14:00 Evaluation of Preventable Trauma Death Rate in Korea <i>Yoon Kim (Seoul National University, Korea)</i>	13:30-13:45 Duet Presentation 1 (Gachon University, Korea) <i>Gil Jae Lee &amp; Jeong Ho Kim</i>
	14:00-14:30 EMS-Assessed Mass Casualty Incident/Severe Trauma Database of Korea <i>Kyoung-Jun Song (Seoul National University, Korea)</i>	13:45-14:00 Duet Presentation 2 (Mokpo Hankook Hospital, Korea) <i>Bo-Ra Seo &amp; Yong Tae Kim</i>
		14:00-14:15 Duet Presentation 3 (Pusan National University, Korea) <i>Kwang Hee Yeo &amp; Hoon Kwon</i>
14:30-15:30		14:15-14:30 Discussion <i>Panelists: Hwan Jun Jae (Seoul National University, Korea) Chang Won Kim (Pusan National University, Korea) Hangjoo Cho (The Catholic University of Korea, Korea) Byungchul Yu (Gachon University, Korea)</i>
	Oral Session 7: Polytrauma	
	Session Director: Nam Ryeol Kim (Korea University, Korea)	Panel Discussion: Evidence-Based ICU Care
	Moderator: Jung Nam Lee (Gachon University, Korea) Nam Ryeol Kim (Korea University, Korea)	Session Director: Ye Rim Chang (Dankook University, Korea)
	14:30-14:45 Gun Shot Injury <i>John Cook-Jong Lee (Ajou University, Korea)</i>	14:30-14:50 Nutrition <i>Pil Young Jung (Yonsei University Wonju College of Medicine, Korea) Ye Rim Chang (Dankook University, Korea)</i>
	14:45-15:30 Oral Presentation (OP7)	14:50-15:10 PAD <i>Dong Hun Kim (Dankook University, Korea) Min A Lee (Gacheon University, Korea)</i>
15:35-16:00	Coffee Break	
16:00-17:00	General Meeting (Korean Society of Traumatology)	
17:00-17:30	Award Ceremony	
17:30	Closing	

# Table of Contents

• Oral Session 1: Trauma Care	1
• Paramedic Education	15
• Plenary Session 1	21
• Plenary Session 2	25
• Oral Session 2: Nutrition	29
• Luncheon Seminar 1	35
• Special Lecture Session 1: Future of Trauma in Korea	45
• Management of Pediatric Unstable Pelvic Ring Injury: Panel Discussion	49
• Oral Session 3: Infection	53
• Current Guidelines for Severe TBI	61
• Oral Session 4: Intervention	67
• Nurses in Trauma Field	75
• Oral Session 5: Resuscitation	81
• Oral Session 6: Research	91
• Mini Oral Presentation 1 (MINI-OP1)	101
• Mini Oral Presentation 2 (MINI-OP2)	113
• International Symposium 1: Disaster (Language: English)	125
• Trauma QI	129
• International Symposium 2: MTP (Language: English)	131
• Trauma Video Session 1: Specific Procedures in Trauma	135
• International Symposium 3: Hybrid ER/OR (Language: English)	141
• Trauma Video Session 2: Trauma Surgery	145
• Luncheon Seminar 2	151
• Special Lecture Session 2: System	155
• Debate Session: Multidisciplinary Collaboration	159
• Oral Session 7: Polytrauma	167
• Panel Discussion: Evidence-Based ICU Care	177
• Poster Presentation	189

# Table of Contents

## (Oral Presentation & Poster Exhibition)

<b>Oral Session 1: Trauma Care</b> .....	<b>1</b>
OP1-1 Effectiveness of Designation of Regional Trauma Center: A Comparison Study of before and after .....	9
OP1-2 Effects of Trauma Center Establishment on Patient Characteristics and Outcomes: ..... A Retrospective Analysis from a Single Trauma Center in Korea	10
OP1-3 Evaluation of Trauma Related Preventable Death Using Panel ..... Discussion in a Level 1 Trauma Center: Single Center Experience	11
OP1-4 International Rotation at Tygerberg Hospital in South Africa: ..... Comparison of Surgical Volume in Urban Trauma Center in Tokyo	12
OP1-5 Prevalence of Process Errors in a Trauma Center: Single Institutional Study .....	13
OP1-6 The 1st Period of Neurotrauma Databank in the Korean Neurotraumatology Society .....	14
<b>Oral Session 2: Nutrition</b> .....	<b>29</b>
OP2-1 Effect of Early Enteral Nutrition on the Incidence of Acute Acalculous Cholecystitis among Trauma Patients....	33
OP2-2 Nutritional Support after Emergency GI Surgery .....	34
<b>Oral Session 3: Infection</b> .....	<b>53</b>
OP3-1 Factors Affecting Morbidity in Trauma Patients: A Propensity Score-matched Analysis .....	56
OP3-2 25 Cases of Unexpected Complications of Surgical Stabilization of Rib Fractures .....	57
OP3-3 Effectiveness on Wound Closure using Vacuum Assisted Closure Therapy ..... for Patients Who Sustained High Velocity Gunshot Wounds: Case Series	58
OP3-4 Surgical Site Infections after Fracture Management with Hardware in Place .....	59
OP3-5 Early Predictors for In-hospital Mortality in Elderly Trauma Patients .....	60
<b>Oral Session 4: Intervention</b> .....	<b>67</b>
OP4-1 Angiographic Embolization for Pelvic Fractures in Older Patients .....	70
OP4-2 Efficacy and Safety of Distal and Proximal Splenic Artery Embolization ..... in Traumatic Splenic Injury: Preliminary Results	71
OP4-3 Role of Interventional Radiology in Trauma Care: ..... Retrospective Study from Single Trauma Center Experience	72
OP4-4 Transcatheter Arterial Embolization for Management of Traumatic Bleeding: Single-Center Experience...	73
OP4-5 Transcatheter Arterial Embolization for Traumatic Thoracic Bleeding: ..... 4-years Experiences in a Single Trauma Center	74

<b>Oral Session 5: Resuscitation</b>	<b>81</b>
OP5-1 Resuscitative Endovascular Balloon Occlusion of the Aorta: A Single Trauma Center Experience in Korea	85
OP5-2 An Analytical Study for Blood Transfusion in Trauma Patients at a Regional Emergency Department	86
OP5-3 Prediction of Patients with Major Trauma Requiring Massive Blood Transfusion: A Comparison of ABC, TASH, PWH, SI Scores in Korean Trauma Patients	87
OP5-4 Blood Pressure and Pulse Rate Changed before and after Decompression Surgery: Reverse Cushing Phenomenon	88
OP5-5 The Appropriateness of Routine Chest Decompression for Traumatic Cardiorespiratory Arrest	89
OP5-6 Initial Experience of REBOA for Severe Trauma in Single Institution: Case Series	90
<b>Oral Session 6: Research</b>	<b>91</b>
OP6-1 Serial Measurement of Immune Cells in Severe Trauma Patients	94
OP6-2 A Hands-on Course on Endovascular Training for Resuscitative Endovascular Balloon Occlusion of the Aorta (ET-REBOA)	95
OP6-3 Predictive Values of Magnetic Resonance Imaging Features for Tracheostomy in Traumatic Cervical Spinal Cord Injury	96
OP6-4 Effect of Obesity by Sex on Traumatic Brain Injury in Motor Vehicle Collisions	97
OP6-5 The Validity of the Korean Triage and Acuity Scale in Trauma Patients with Low Consciousness	98
OP6-6 Comparison of the Various Surgical Approaches for Traumatic Frontal ICH	99
<b>Mini Oral Presentation 1 (MINI-OP1)</b>	<b>101</b>
MINI-OP1-01 Tracing the Use of Cautery in the Modern Surgery	103
MINI-OP1-02 The Analysis of Traumatic Abdominal Wall Hernia According to the Energy Level of Trauma	104
MINI-OP1-03 The Relationship between CDC Field Triage and Injury Severity Score	105
MINI-OP1-04 Characteristics of Adolescents Who Present Dominantly with Traumatic Events among Adolescent Patients Who Frequently Visit the Emergency Department	106
MINI-OP1-05 Clinical Analysis of the Patients with Isolated Low-velocity Penetrating Neck Injury	107
MINI-OP1-06 Good Bye to Romance: Trauma Surgery in the Korean Trauma Center	108
MINI-OP1-07 Will Segmental or Displaced Rib Fractures Really Affect Adverse Outcome? A Retrospective Study: 145 Isolated Blunt Chest Trauma Patients with Rib Fractures	109
MINI-OP1-08 Characteristics of the Accident and Cause of the Death According to Age Groups in Elderly Motor Vehicle Driver Accidents	110
MINI-OP1-09 Esophageal Rupture due to Diving in Shallow Waters: A Case Report	111
MINI-OP1-10 Analysis of Mortality and Epidemiology in 2617 Cases of Traumatic Brain Injury: Korean Neuro-Trauma Data Bank System 2010-2014	112

<b>Mini Oral Presentation 2 (MINI-OP2)</b>	<b>113</b>
MINI-OP2-01 Three-Dimensional Analysis of Posterolateral Bare Area Support of Tibial Plateau Fractures: How Does Variable Angle Locking Compression Plate Fixation Compare to Conventional Locking Compression Plate Fixation?	115
MINI-OP2-02 Results of Fragment Specific Fixation Technique for Posterior Wall Fracture of the Acetabulum	116
MINI-OP2-03 A Treatment Strategy to Avoid Iatrogenic Pipkin Type III Femoral Head Fracture-dislocations	117
MINI-OP2-04 Case-Match Controlled Comparison of Bone Transport over the Nail and Bone Transport over the Plate for the Segmental Bone Defect of Tibia	118
MINI-OP2-05 Minimally Invasive Plate Osteosynthesis in Type C Fibular Fractures Combined with High Energy Lower Leg Injury	119
MINI-OP2-06 Immediate Shoulder Exercises Overcome the Shortcomings of the Conservative Treatment in Midshaft Clavicle Fractures	120
MINI-OP2-07 Treatment for Patients with Radial Nerve Palsy Showing the Distraction of Fracture Gap in Transverse Humeral Shaft Fracture	121
MINI-OP2-08 Analysis of a Survey on Orthopaedic Residency Training for Fracture Treatment in Korea	122
MINI-OP2-09 Intraoperative Transcranial Sonography for Detection of Contralateral Hematoma Volume Change in Patients with Traumatic Brain Injury	123
MINI-OP2-10 Determining the Lower Limit of Cerebral Perfusion Pressure in Patients Undergoing Decompressive Craniectomy Following Traumatic Brain Injury	124
<b>Oral Session 7: Polytrauma</b>	<b>167</b>
OP7-1 The Management of Stab Injury on Torso: A Single Trauma Center Experience	170
OP7-2 Experiences of a Disaster Medical Assistant Team (DMAT) in Fire Disaster at Jecheon Sports Complex Center: Limitation and Importance of Rescue	171
OP7-3 Analysis of Injury Mechanism of the Elderly and Non-Elderly Groups in Motor Vehicle Minor Crash Accidents	172
OP7-4 The Clinical Implications of Severe Low Rib Fracture in the Management of Diaphragm Injury	173
OP7-5 Pelvic Fracture Type as a Risk Factor for Mortality in Patient with Pelvic Fractures	174
OP7-6 Strategies for the Management of Hemodynamically Unstable Pelvic Fractures: From Preperitoneal Pelvic Packing to Definitive Internal Fixation	175
<b>Poster Presentation</b>	<b>189</b>
EP-001 A Case of Atlanto-occipital Dislocation with Progressive Neurologic Deterioration	191
EP-002 A Case of Penetrating Brain Injury by Nail Gun	192
EP-003 A Case Spinal Epidural Hematoma after Minor Indirect Trauma - Impact of NOAC	193
EP-004 Aberrant Left Internal Iliac Artery Originating from the Aortic Bifurcation	194
EP-005 Accidental Finding of Ascaris Lumbricoides during Abdominal Penetrating Trauma Surgery: A Case Report	195
EP-006 Anterior Cervical Osteophyte (C1-C2) and Dysphagia a Case Report	196

EP-007	Bilateral Craniectomies in Acute Both Subdural Hematoma and Endoscopic Removal ..... 197 of Epidural Hematoma due to Injury of Superior Sagittal Sinus	197
EP-008	Cervical Epidural Hematoma that Induced Sudden Paraparesis ..... 198 after a Cervical Spine Massage: A Case Report	198
EP-009	Clinical Outcomes of Mini Plate Augmented Fixation in Complex Patellar Fracture ..... 199	199
EP-010	Clinical Results of Rim Plating Technique Using 2.7 mm VA LCP in Tibial Plateau Fracture ..... 200	200
EP-011	Comparison of Outcomes before and after Establishing a Regional Trauma Center and ..... 201 Following a Protocol to Treat Blunt Splenic Injury in South Korea: A Retrospective Study	201
EP-012	Comparison of Sagittal Values between Lateral Decubitus Plain Radiography and ..... 202 Supine Computed Tomography in Thoracolumbar Fractures - A Greater Degree of Kyphosis is Observed in Plain Radiography than CT	202
EP-013	Comparisons of CT Perfusion Parameters of Blunt Liver Trauma between Groups Treated ..... 203 with Angioembolization and Conservative Management	203
EP-014	Conservative Treatment of Acute Traumatic Left Renal Vein Occlusion: ..... 204 Implication of Left Gonadal Vein	204
EP-015	Decompression with "Lateral Pediclectomy" and Circumferential Reconstruction ..... 205 for Unstable Thoracolumbar Burst Fractures: Surgical Techniques and Results in 18 Patients	205
EP-016	Delayed Cerebral Air Embolism with Patent Subcutaneous ..... 206 Tract Following Central Venous Catheter Removal	206
EP-017	Effect of Hypoxia and Medicines on the Immune Cells ..... 207	207
EP-018	Experience of Penetrating Gunshot Wound on Head in Korea: Case Report ..... 208	208
EP-019	Fatal Post-operative Epilepticus after Burr-Hole Drainage ..... 209 for Chronic Subdural Hematoma in Elderly Patient	209
EP-020	Interventional Urethral Realignment as a Radical Treatment in ..... 210 Posterior Urethral Disruption Accompanied by Complex Pelvic Fracture	210
EP-021	Isolated Pancreatic Transection due to Motorcycle Accident ..... 211 with Endoscopic Treatment: A Case Report	211
EP-022	Operation Experience of Regional Trauma Center in Gangwon Province ..... 212	212
EP-023	Outcomes Following Treatment of Geriatric Distal Femur Fractures ..... 213	213
EP-024	Outcomes of Emergency Department Laparotomy in Non-responder ..... 214 after Resuscitation: Early Experience in a Single Center	214
EP-025	Percutaneous Drainage of Huge Hepatic Subcapsular Hematoma ..... 215 in Chronic Renal Failure after Blunt Abdominal Trauma	215
EP-026	Post-traumatic Delayed Rupture of Pseudoaneurysm of Spleen ..... 216	216
EP-027	Post-traumatic Pseudoaneurysms of Left Gastric Artery ..... 217	217
EP-028	Predictive Factor for Sepsis in Korean Traumatic Patients ..... 218	218
EP-029	Relationship between Injury Patterns and Severity of ..... 219 Trauma Patients with Meteorological Patterns in Jeju Island	219
EP-030	Selective Transarterial Embolization of Grade IV Hepatic Injury by Blunt Trauma ..... 220	220

EP-031	Shattered Spleen in Blunt Trauma: Clinical Results of Trans-arterial Embolization, ..... 221 4-years Experiences in a Single Regional Trauma Center	221
EP-032	Successful Percutaneous Coronary Intervention (PCI) ..... 222 <b>Withdrawn</b>	222
EP-033	Successful Percutaneous Coronary Intervention in a Case ..... 223 of Right Coronary Artery Dissection after Blunt Chest Trauma	223
EP-034	Surgical Treatment of Mandible Fracture Using Unsintered ..... 224 Hydroxyapatite/Poly L-lactide Composite Fixation System	224
EP-035	Thoracoscopic Approach and Reconstruction to the Mid-thoracic Fractures ..... 225	225
EP-036	Thoracoscopic Transdiaphragmatic Approach to L2 Fractures ..... 226	226
EP-037	Wide Decompressive Craniectomy in Traumatic SDH ..... 227 with Multiple Dural Fenestration Technique	227

## Oral Session 1: Trauma Care

**Session Director**

Woo Jin Jung (Yonsei University Wonju College of Medicine, Korea)

**Moderator**

Seok Ho Choi (Dankook University, Korea)

Seung Hwan Pyun (Armed Forces Yangju Hospital, Korea)

- 
- Trauma Team Activation Criteria: Full Trauma Team Activation or Modified Trauma Team Activation?
  - Oral Presentation (OP1)



# Trauma Team Activation Criteria: Full Trauma Team Activation or Modified Trauma Team Activation?

Seok Ran Yeom

Pusan National University, Korea

## □ Field Triage Guidelines for trauma patient in Korea (2012')

1. 단계: 생리학적 소견, 비정상 비정상 개정손상지수(Revised Trauma Score)기준

- ㉠ 의식수준이(V, P, U)
- ㉡ 수축기혈압 < 90 mmHg
- ㉢ 호흡수 < 10회/min 또는 > 29회/min
- ㉣ 호흡보조가 필요한 상황

2. 단계: 신체검사 소견

- ㉠ 관통 또는 자상(머리/목/가슴/배/상완/대퇴부)
- ㉡ 흉곽의 불안정 또는 변형(동요가슴)
- ㉢ 두 개 이상의 근위부 긴뼈 골절
- ㉣ 압궐/벗겨진/찢린/맥박이 소실된 사지
- ㉤ 손목 또는 발목 상부의 절단
- ㉥ 골반골 골절
- ㉦ 두개골의 열린 또는 함몰 골절
- ㉧ 외상성 마비

3. 단계: 손상기전

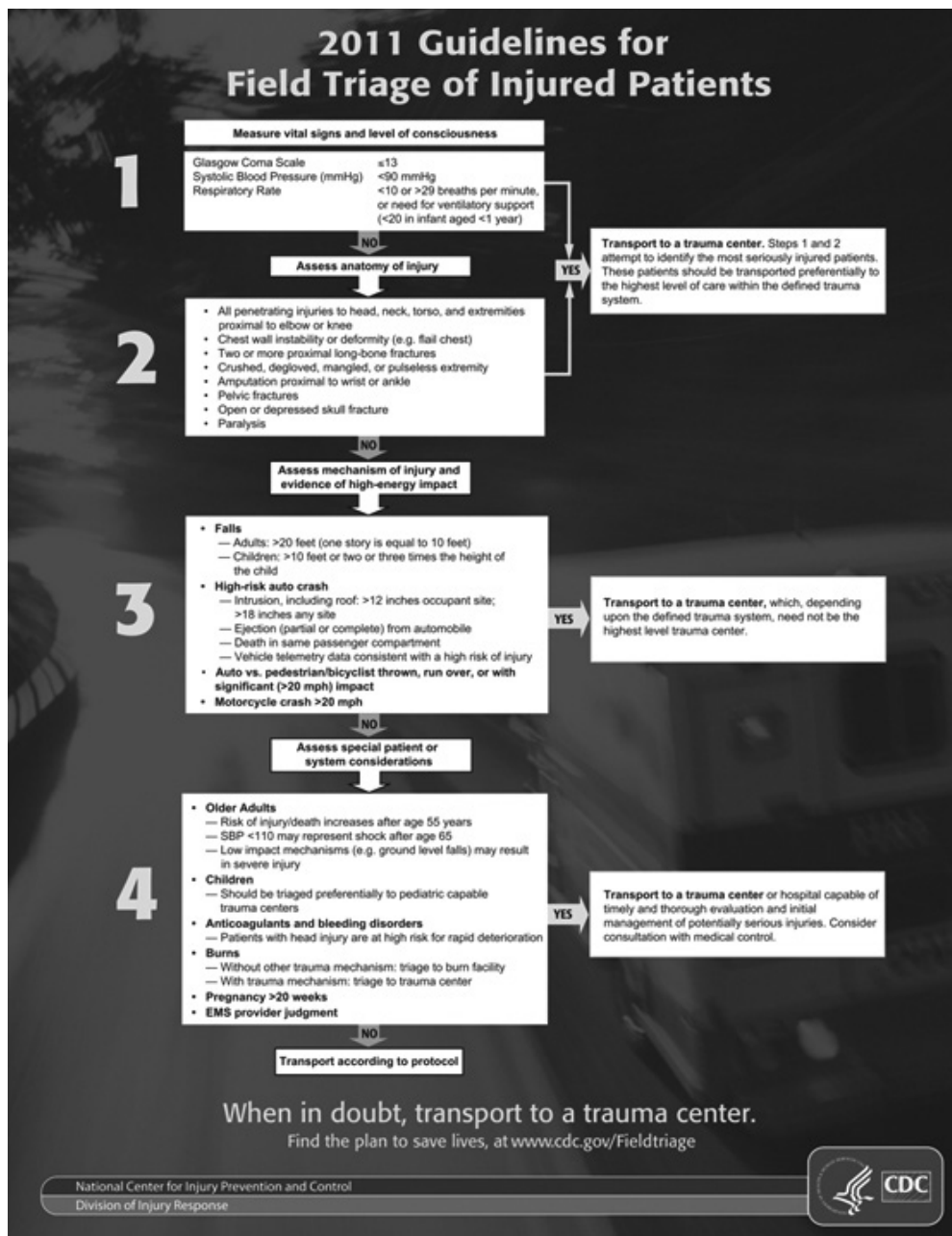
- ㉠ 고층 낙상(성인 6 m/소아 3 m)
- ㉡ 고위험 교통사고: 차체 눌림(찌그러짐): 30 cm 이상, 자동차에서 이탈(튀겨져 나감), 동승자의 사망, 차량 전복
- ㉢ 자동차 대 보행자/자전거 사고
- ㉣ 30 km/h 이상 속도의 오토바이 사고

4. 단계: 중증외상센터로의 이송을 심각하게 고려해 볼 수 있는 환자의 의학적 질병상태 및 특수상황

- ㉠ 55세이상, 15세 이하
- ㉡ 항응고 치료

- ㉔ 출혈성 질환
- ㉕ 화상과 외상이 동반
- ㉖ 투석필요
- ㉗ 시간을 다투는 사지손상
- ㉘ 임신 20주 이상
- ㉙ 기타 구급대원의 판단

□ 2011 GL for Field Triage of Injured Patients of CDC



□ Trauma Team Activation Criteria of Trauma center in Korea

1. 생리학적 기준
  - A. 기도폐쇄/호흡 저하
  - B. 도착 전 기도 삽관 상태
  - C. 성인 : 호흡수 <10회/분 또는 >30회/분
  - D. 성인 : 수축기 혈압 <90mmHg
  - E. 성인 : 심박수 >100bpm
  - E. GCS <13
  - F. 활력 징후 유지를 위해 수혈하면서 전원 된 환자
  - G. 안정된 환자에게서 상태 악화
2. 해부학적 기준
  - A. 관통상
    - i 두경부, 흉부, 복부 관통상
    - ii 사지 : 팔꿈치 또는 무릎 상방 근위부 관통상
  - B. 흉부
    - i 동요흉(Flail Chest)
  - C. 신경
    - i 개방성 또는 함몰성 두개골절
    - ii 사지마비 또는 척수손상 의심
  - D. 정형
    - i 골반골 골절
    - ii 두 개 이상의 근위부 장골 골절
    - iii 사지의 압궤/벗겨진/찢린 손상 또는 맥박 소실
    - iv 손목 또는 발목 상방 근위부 절단
3. 손상기전
  - A. 자동차간의 충돌 사고에서 동승자 사망
  - B. 자동차간의 사고에서 차량에서 이탈 된 환자
  - C. 시속 60km 이상의 충돌 교통사고
  - D. 시속 30km 이상의 자동차와 보행자의 사고
  - E. 환자 구출에 20분 이상 소요 (자체 놀림 30cm 이상)
  - F. 오토바이, 자전거, 기타 탈 것 : 시속 30km 이상의 충돌 혹은 전복사고
  - G. 성인 6m 이상, 소아 3m 이상의 낙상
  - H. 폭발에 의한 손상

※ 기타 소방구역에 상주하는 전담의가 필요성이 있다고 판단되는 경우.

- Oversea trauma center full trauma Team activation vs. modified trauma team activation system
- Australia Severe trauma center TTA protocol

**Table 1**

Triage criteria for full trauma and consult trauma responses.

Full trauma	Consult trauma
<i>Vital signs</i> SBP < 90 mmHg RR < 10 or > 29 HR < 50 or > 120 bpm GCS ≤ 13 or fitting Age > 65 with SBP < 100 mmHg or GCS ≤ 14 <i>Major injuries</i> Any evidence of airway obstruction or compromise Penetrating injury to head, neck or torso Flail chest Suspected spinal cord injury 2 or more long bone fractures Multiple body region injuries Amputation/crush injury proximal to wrist/ankle	<i>No vital sign or anatomic injury criteria</i> <i>Mechanism</i> Any motor vehicle at high speed (>60 kph) Ejection or rollover or death of vehicle occupant Pedestrian struck by moving vehicle Bicycle accident >20 kph impact Fall > 3 m Motorcycle accident with separation from vehicle Prolonged extrication time >20 min

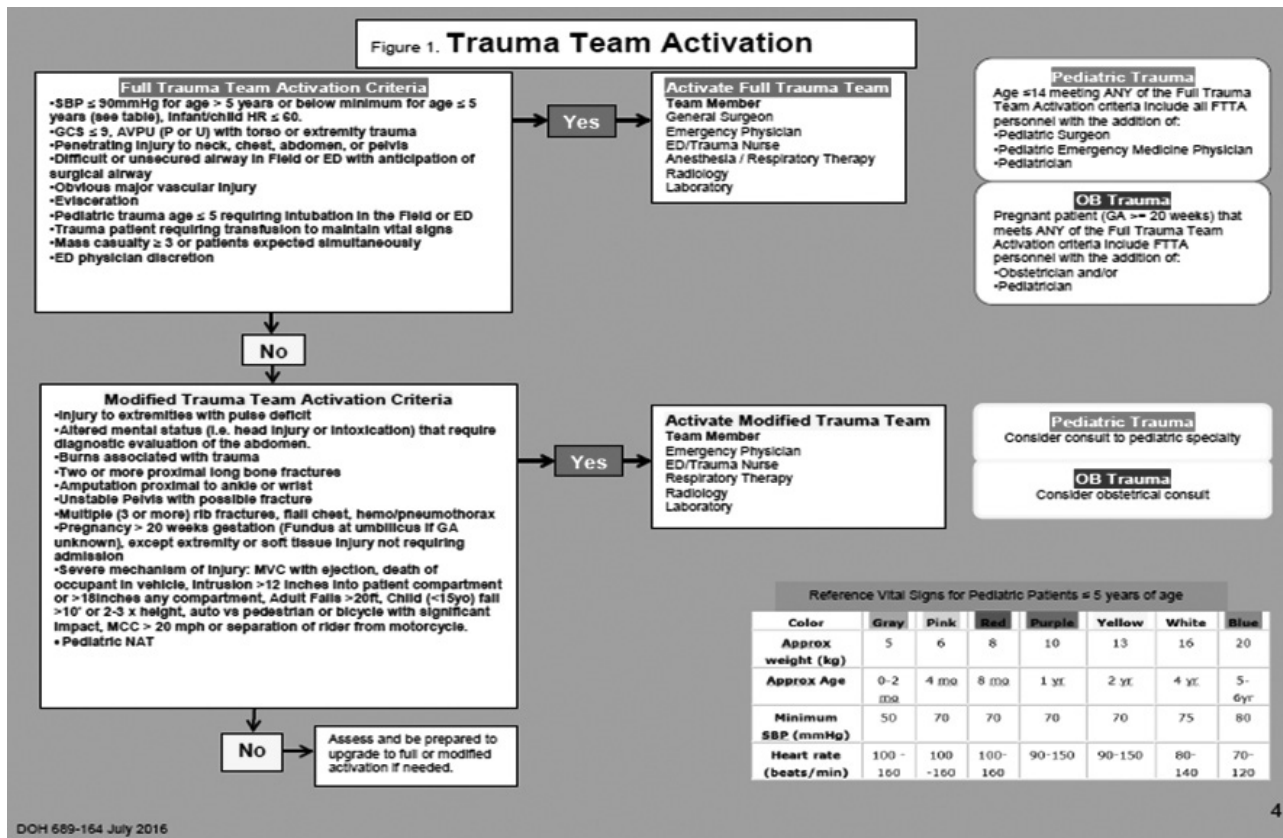
- San-Francisco Level I trauma center TTA GL
- Minnesota TTA system

Tier-1 activation (Full trauma activation)	Tier-2 activation (Consult trauma activation)
<ul style="list-style-type: none"> <li>• Emergency physician</li> <li>• General surgeon (present within 30 minutes of patient's arrival)</li> <li>• Operating room team</li> <li>• Two emergency department RNs</li> <li>• Nursing supervisor</li> <li>• Emergency department tech or EMT</li> <li>• Respiratory therapy</li> <li>• Anesthesia</li> <li>• Laboratory technician</li> <li>• Radiology technician</li> <li>• Emergency department HUC</li> <li>• Security</li> <li>• Social services</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency physician</li> <li>• Two emergency department RNs</li> <li>• Nursing supervisor</li> <li>• Emergency department tech or EMT</li> <li>• Radiology technician</li> <li>• Laboratory technician</li> <li>• Emergency department HUC</li> <li>• Security</li> </ul>

○ Washington state Trauma center TTA stage (2016')

<p>First-tier trauma team activation criteria (Multiple criteria applied—except for criteria with *)</p> <p>Trauma arrest*</p> <p>Heart rate &lt; 50 or &gt; 120 beats/min</p> <p>Respiratory rate &lt; 10 or &gt; 29 breaths/min</p> <p>Systolic blood pressure &lt; 90 mm Hg</p> <p>Glasgow Coma Scale score &lt; 10</p> <p>Skin pale, cool, or moist</p> <p>Paralysis</p> <p>Gunshot wound to torso, head, or neck</p> <p>Burn ≥ 20% body surface area</p> <p>Age &gt; 65 years and second-tier criterion</p> <p>Other/judgment*</p>
<p>Second-tier trauma team activation criteria (Only one criterion applied†)</p> <p>Stab wound to torso, head, neck, or thigh</p> <p>Gunshot wound to extremity</p> <p>Fall ≥ 20 feet</p> <p>Motor vehicle crash with ejection†</p> <p>Motor vehicle crash with rollover†</p> <p>Motor vehicle crash with death of occupant†</p> <p>Motorcycle crash with separation of rider</p> <p>Pedestrian hit by motor vehicle</p> <p>Multisystem trauma (and no other second-tier criterion)</p> <p>Crush or degloving injury to extremity</p> <p>Other/judgment</p>

Full Trauma Team Activation (FTTA)	Full Trauma Team Members:
<ul style="list-style-type: none"> <li>•SBP ≤90 mmHg for age &gt;5 years or below minimum for age ≤ 5 years (see table), infant/child HR ≤ 60.</li> <li>•GCS ≤ 9, AVPU (P or U) with torso or extremity trauma</li> <li>•Penetrating injury to neck, chest, abdomen, or pelvis</li> <li>•Difficult or unsecured airway in Field or ED with anticipation of surgical airway</li> <li>•Obvious major vascular injury</li> <li>•Evisceration</li> <li>•Pediatric trauma age ≤ 5 requiring intubation in the Field or ED</li> <li>•Trauma patient requiring transfusion to maintain vital signs</li> <li>•Mass casualty ≥ 3 or patients expected simultaneously</li> <li>•ED physician discretion</li> </ul>	<p>General Surgeon</p> <p>Emergency Physician</p> <p>ED/Trauma Nurse</p> <p>Anesthesia / Respiratory Therapy</p> <p>Radiology</p> <p>Laboratory</p>
Modified Trauma Team Activation (MTTA)	Modified Trauma Team Includes:
<ul style="list-style-type: none"> <li>•Injury to extremities with pulse deficit</li> <li>•Altered mental status (i.e. head injury or intoxication) that require diagnostic evaluation of the abdomen.</li> <li>•Burns associated with trauma</li> <li>•Two or more proximal long bone fractures</li> <li>•Amputation proximal to ankle or wrist</li> <li>•Unstable Pelvis with possible fracture</li> <li>•Multiple (3 or more) rib fractures, flail chest, hemo/pneumothorax</li> <li>•Pregnancy &gt;20 weeks gestation (Fundus at umbilicus if GA unknown), except extremity or soft tissue injury not requiring admission</li> <li>•Severe mechanism of injury: MVC with ejection, death of occupant in vehicle, intrusion &gt;12 inches into patient compartment or &gt;18inches any compartment, Adult Falls &gt;20ft, Child (&lt;15yo) fall &gt;10' or 2-3 x height, auto vs pedestrian or bicycle with significant impact, MCC &gt;20 mph or separation of rider from motorcycle.</li> <li>• Pediatric NAT</li> </ul>	<p>Emergency Physician</p> <p>ED/Trauma Nurse</p> <p>Respiratory Therapy</p> <p>Radiology</p> <p>Laboratory</p>



## Effectiveness of Designation of Regional Trauma Center: A Comparison Study of before and after

Kyounghwan Kim, Sungho Han, Soonho Chon, Joongsuck Kim, Ohsang Kwon, Minkoo Lee, Hohyoung Lee

Jeju Regional Trauma Center, Cheju Halla General Hospital

### Objective

his hospital has been operating an inclusive trauma system with sponsorship and financial support since the designation of the regional trauma center in November 2016. The aim of this study is to evaluate the influence of the inclusive trauma system on the effectiveness of regional trauma center's management.

### Methods

Trauma data between January 2016 and October 2017 from a regional trauma center registry were collected and retrospectively reviewed. Trauma patients who had Injury Severity Score (ISS) greater than 15 were included. We compared annual general characteristics, transportation pathways, ISS, time spent in the emergency room, and in-hospital mortality.

### Results

The annual numbers of enrolled patients before and after designation were 128.6 and 147.1, respectively. No significant differences were found in the annual patient's median ages, transportation pathways, ISS, time spent in the emergency room and in-hospital mortality. The annual proportion of the patients who had ISS greater than 15 increased.

### Conclusion

Through the establishment of the regional trauma center, the number of total patients and the annual proportions who had ISS greater than 15 increased but not the annual median lengths of stay in ED. More multidisciplinary cooperation and well-organized study is needed to reduce mortality of major trauma patients and maximize the effect of the regional trauma center.

## Effects of Trauma Center Establishment on Patient Characteristics and Outcomes: A Retrospective Analysis from a Single Trauma Center in Korea

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Kyu-Hyouck Kyoung<sup>2</sup>, Soon Chan Kwon<sup>1</sup>, Min Soo Kim<sup>1,2</sup>

<sup>1</sup>Departments of Neurosurgery, <sup>2</sup>Trauma Center, Ulsan University Hospital University of Ulsan College of Medicine

### Objective

To investigate the effects of trauma center establishment on the clinical characteristics and outcomes of trauma patients with traumatic brain injury (TBI).

### Methods

We enrolled 322 patients with severe trauma and TBI from January 2015 to December 2016. Clinical factors, indexes, and outcomes were compared before and after trauma center establishment (September 2015). The outcome was the Glasgow Outcome Scale (GOS) classification at 3 months post-trauma.

### Results

Of the 322 patients, 120 (37.3%) and 202 (62.7%) were admitted before and after trauma center establishment, respectively. The two groups were significantly different in age ( $p=0.0038$ ), the trauma location within the city ( $p=0.010$ ), the proportion of intensive care unit (ICU) admissions ( $p=0.001$ ), and the emergency room stay time ( $p<0.001$ ). Mortality occurred in 37 (11.5%) patients. However, the mortality ( $p=0.776$ ) and GOS at 3 months ( $p=0.341$ ) were not significantly different from before to after trauma center establishment. None of the clinical factors, indexes, or outcomes were different from before to after center establishment for patients with severe TBI (Glasgow Coma Scale [GCS] score  $\leq 8$ ).

### Conclusion

We confirmed that for patients with severe trauma and TBI, establishing a trauma center increased the rate of ICU admission and decreased the emergency room stay time, although the patient outcomes did not change. In patients with severe TBI, no changes in outcome occurred from before to after trauma center establishment. Longitudinal analyses are needed to identify changes occurring after trauma center establishment.

## Evaluation of Trauma Related Preventable Death Using Panel Discussion in a Level 1 Trauma Center: Single Center Experience

Ji Young Jang, Hongjin Shim, Pil Young Jung, Seongyup Kim, Kwangmin Kim, Hui Jae Bang, Keum Seok Bae

Yonsei University Wonju College of Medicine

### Introduction

A national wide study using panel discussion method in 2012 presented about 35% of trauma related Preventable death (PD), however few literatures about PD evaluation of each trauma center have been published since Korean regional trauma center project was started in 2012. Therefore, the purpose of this study was to evaluate trauma related PD rate using panel discussion method and to analyze the pattern of PD at a regional trauma center for two years.

### Method

Between October 2015 and September 2017, mortality cases were enrolled in this study. Five committee members who consisted of two general surgeons, one cardiothoracic surgeon, one neurosurgeon, and one emergency medicine doctor evaluated whether patients' mortalities were preventable through nine panel discussion conferences. A Unanimous vote was used in the decision. Errors were respectively identified in prehospital, emergency room (ER), operation room, intensive care unit, and ward stages.

### Results

During study period, 249 patients died, their mean age was 58.0 years and the mean ISS was 27.3. There was no return of spontaneous circulation (ROSC) in 81 patients (32.5%) after cardio-pulmonary resuscitation (CPR) status in the time of ER arrival. NP death rated at 185 (74.3%), NPCI at 27 (10.8%), PP at 29 patients (11.6%), and P at 8 (3.2%). When errors in respective stage were assessed, error of pre-hospital stage was most common, followed by 8% of ER stage. Overall PD rate was 14.9%. There was no statistical difference in PD rate from 1st to 9th panel discussion ( $p=0.479$ )

### Conclusion

PD rate of regional trauma center was 14.9%, and especially it was found that there were many problems in the inter-hospital and pre-hospital transport.

## International Rotation at Tygerberg Hospital in South Africa: Comparison of Surgical Volume in Urban Trauma Center in Tokyo

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Yasufumi Miyake<sup>1</sup>, Liezel Taylor<sup>2</sup>, Zamira Keyser<sup>2</sup>, Elmin Steyn<sup>2</sup>, Tetsuya Sakamoto<sup>1</sup>

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### Introduction

International rotation will get a chance of operations which surgeon rarely experienced in his own countries. The author has rotated in six months at Tygerberg hospital (TB) in South Africa.

### Objective

The purpose of this study was to compare the volume between our trauma center in Tokyo and TB in South Africa.

### Methods

We conducted the retrospective chart review at our trauma center in Tokyo and compare to the surgical volume which I experienced in TB for six months and the total number of operations which underwent in the same period in Tokyo.

### Results

The number of operations he joined in TB was 175, and 151 of them were for trauma cases. The number of urgent trauma operations was 102 (68%), and that of penetrating and blunt injuries, GSW and Stab injuries were 85 (83%), 17 (17%), 46 (45%) and 39 (38%) respectively. Cardiac or large vessel injuries were 40 cases including 2 cardiac, 2 aortic, 5 subclavian artery, 6 iliac vessels, and 8 inferior vena cava injuries.

The total number of operations in Tokyo was 107. Of the 107 cases, trauma cases were 35 (33%) and urgent trauma operations were 19 (54%). Six (32%) were penetrating injury and 13 (68%) as the result of blunt trauma.

The number of trauma operations he experienced in South Africa was approximately 5 times as many as the number of all trauma operations at the trauma center in Tokyo. Penetrating cases in South Africa were 14 times as many as in Tokyo.

### Conclusion

The on-the-job training during the international rotation in South Africa is significantly helpful to study trauma surgery, especially penetrating injuries. We strongly recommend it to overcome the problems associated with the low volume.

## Prevalence of Process Errors in a Trauma Center: Single Institutional Study

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### Purpose

The trauma center plays an important role for the management of seriously injured trauma patients. Despite of great advances of the system of trauma centers, there still remained various clinical errors when manage complex problems of trauma patients. We evaluated the various kinds of clinical errors during the management of trauma patient. In this study, we analyzed the rates of clinical errors in our trauma centers.

### Methods

306 patients visited our trauma center for trauma injury from May 2016 to Feb 2017. We has recorded various kinds of clinical errors during the management of trauma patients from emergency room (ER) arrival to discharge from hospital, for example time of ER stay, time to the emergent operation room after patient arrival, medical errors, complications and mortality. We evaluated the rates of these errors.

### Results

Among 306 patients 261 (85%) were classified process error group. The duration of ER stay until hospitalization was 438 minutes and thoracic surgery part has the longest stay time (720 minutes). The rate of delay for optimal timing for surgery or angio-embolization was 82% (63/72). The rate of missed diagnosis was 28% (85/306) and findings included others (36%), extremity (33%), chest (17%), abdomen (15%) in order. The rate of complication was 29% (89/306) and pulmonary complications were the most common (25%). There was no significant difference of errors in optimal timing for surgery or angio-embolization, missed diagnosis, and duration of ER stay between mortality group and survivor group ( $p>0.001$ ). But More frequent missed diagnosis missed diagnosis were identified in patients admitting  $>7$  days than patients admitted during 7 or under 7 days ( $p=0.035$ ).

### Conclusions

This study announce error incidence in trauma patients and classify them according to type. Various errors originate in the absence of communication between the trauma surgeon and other parts. Larger prospective observational studies should be considered to find errors affecting clinical outcomes.

**Keywords:** Trauma, Process, Error

## The 1st Period of Neurotrauma Databank in the Korean Neurotraumatology Society

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<sup>1</sup>Soonchunhyang University Bucheon Hospital, <sup>2</sup>Hallym University Sacred Heart Hospital, <sup>3</sup>Hallym University Gandong Sacred Heart Hospital

### Objective

The 1st period of Korean Neurotrauma Data Bank System (KNTDBS) prospectively collected data on hospitalized persons with newly developed head injuries in some nationwide hospitals from 2010-2014. The system was operated by the Korean Neurotraumatology Society. The system and results from the databank will be presented.

### Methods

The data were registered totally through the web system. Twenty-three centers participated and 2617 cases were enrolled at the end of the project. The project intended to set up the databank and know the current status of epidemiology and management in Korea. So, we did not define strict restrictions for the case registration. Dataset had 8 domains; patient information, pre-hospital care, neuroimaging, medical treatment, surgical treatment, neuromonitoring, additional management, and neurologic outcome. And 121 fields were filled up in each case record.

### Results

Retrospectively analyzing study was done in total 2617 cases. The project was ended to have huge enrollment. But, lots of fields in the records were not filled, which prevented the data review from being analyzed precisely. For all this, three peer-reviewed papers were published, which were related to epidemiologic results and outcome of the epidural hematoma.

### Conclusion

Based on the 1st project of KNTDB, we got precious experiences of web-based data registration and current nationwide status for the head injury. We are now preparing the 2nd period of KNTDBS.

## Paramedic Education

**Session Director**

Jundong Moon (Kongju National University, Korea)

**Moderator**

Hyun Ho Ryu (Chonnam National University, Korea)

Hyun Wook Ryoo (Kyungpook National University, Korea)

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- Essential Psychomotor and Cognitive Skills in for Prehospital Trauma Education
- Making Effective Trauma Scenario for High-Fidelity Simulation
- Critical Skill Station Using Animal Model



# Essential Psychomotor and Cognitive Skills in for Prehospital Trauma Education

**Oh Hyun Kim**

Yonsei University Wonju College of Medicine, Korea

PreKTAT (Prehospital Korean trauma assessment and treatment course) was made to provide the principles and updated guidelines in prehospital trauma care in Korea and it could be possible to increase the patients' chance of survival. It also links to KTAT (Korean trauma assessment and treatment course), so it enable to make a consistent management for trauma patients through a whole process from pre-hospital to hospital stage.

Development of the preKTAT course began in 2013 and it first started in Bexco, Pusan at 2013 and most recently it held a 3rd course in Bundang Seoul University Hospital at 2016. This is 8hr course for emergency medical technicians and nurses. And it consists of the lectures and practical sessions of the day. Many excellent instructors participate in this course and the instructor of preKTAT is composed of trauma surgeon and emergency medicine physician.

The goals and objectives of PreKTAT course provide an understanding the trauma mechanism and pathophysiology in trauma patients and the necessity of prehospital trauma assessment. It also include the prehospital trauma patient assessment and diagnostic techniques and can improve the participants' performance of trauma patient assessment and treatment.

In the future, the contents of preKTAT course will be update with the society of traumatology, the Korean society of emergency medicine and the standard protocols for 119 emergency medical services providers and it will include the latest studies and new technology in field of prehospital trauma care. and lastly, we also have plan to make a principle book for prehospital trauma care in context with the situation of Korean trauma system.

# Making Effective Trauma Scenario for High-Fidelity Simulation

**Jundong Moon**

Kongju National University, Korea

Simulation is a widely used tool of helping emergency medical service providers learn and keep proficiency in the clinical area for both staff educators in clinical settings and emergency medical services faculty in academic settings. In particular, simulation training is effective in improving clinical decision making skills for prehospital trauma care. Delivering an effective simulation drill, however, requires thoughtful planning, knowledge of educational principles, and knowledge of best practices in both simulation and clinical practice. A goal-directed strategy for writing a simulation scenario using Hi-Fi simulator for emergency medical service instructors and providers will be presented. A step-by-step process is outlined. Examples and suggestions are provided to help audiences build high-quality simulation experiences.

# Critical Skill Station Using Animal Model

**Chan Yong Park**

Wonkwang University Hospital, Korea

Trauma education using animal (porcine) is more effective than simple lecture or simulation training using equipment. The ATOM (Advanced Trauma Operative Management) course which is mainly conducted in the United States and the DSTC (Definite Surgical Trauma Care) course which is mainly carried out in Europe are trauma training programs using animal that are well known throughout the world. In Korea, KARPET (Korean Association for Research, Procedures and Education on Trauma) developed ESPIT (Essential Surgical Procedures in Trauma) course for trauma surgeon in 2014 and performed 11 times. This course has now become a required course for the qualification examination of trauma specialist. But these courses are all for doctors. Therefore KARPET developed the BSPIT (Basic ESPIT) course for nurses and EMT in 2014. But it has been performed 8 times for only nurses and it is very popular. However, education for EMT is not yet realized. The authors hope that a good situation for EMT come true.



## Plenary Session 1

**Session Director**

Bo-Ra Seo (Mokpo Hankook Hospital, Korea)

**Moderator**

Keum Seok Bae (Yonsei University Wonju College of Medicine, Korea)

Byung Moon Cho (Hallym University, Korea)

- 
- Trauma System in Taiwan
  - Moderate and Severe Traumatic Brain Injury:  
Monitoring and Targeted Management for  
Neuroprotection



# Trauma System in Taiwan

**Max, Li-Chien Chien**

Formosa Association for the Surgery of Trauma, Taiwan

Trauma is a serious social health problem in Taiwan like some other modern countries and National health insurance (NHI) was inaugurated in Taiwan on March 1st, 1995 and NHI coverage rate almost reached 99% before 2000. In 2002, the Global Budget System and Hospital Cost Containment system for all admissions were taken into action.

- (1) To describe the achievement of trauma care we have done, and the incidence, the demographics, the mechanisms of injuries, the types of injuries
- (2) To understand the current status of our trauma system, including the pre-hospital EMS, the EM care, the trauma service and the critical care, and the challenges we are facing.
- (3) To introduce the ideal system we will build up in the future.

# Moderate and Severe Traumatic Brain Injury: Monitoring and Targeted Management for Neuroprotection

Kwang wook Jo

Department of Neurosurgery, College of Medicine,  
Bucheon St. Mary's Hospital, The Catholic University of Korea, Seoul, Korea

Traumatic brain injury (TBI) is the leading cause of mortality and morbidity in both developed and developing nations worldwide. TBI is currently managed in the neurointensive care unit (NICU) by neurointensivist. Development in neuromonitoring device and in understanding pathophysiological mechanisms of TBI could enhance targeted interventions that could ultimately improve outcomes. The target of neuromonitoring is a neuroprotection by prompt management of intracranial hypertension and secondary brain injury, maintenance of cerebral perfusion pressure, and ensuring adequate oxygen delivery to injured brain tissue that could give optimize conditions for brain recovery. In this presentation evidence-based approaches to the management of severe TBI will be discussed.

## Plenary Session 2

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Ho-Seong Han (Seoul National University, Korea)

Jong-Seong Ahn (Armed Forces Medical Command, Korea)

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- What is the Next Mission for Trauma Care System in Korea?
- Directions of Military Trauma System Innovation  
(What Should We Focused on Military Trauma System Innovation?)



# What is the Next Mission for Trauma Care System in Korea?

**Kang Hyun Lee**

Yonsei University Wonju College of Medicine, Korea

What is the next mission for trauma care system in Korea? The answer is to solve the current problems well and to implement ideal direction of trauma care system. Trauma is the leading cause of mortality and disability for Koreans under age 44. The rate of preventable trauma death was 50.4% in 1997 and 30.5% in 2015. Our goal is to reduce the under the 20% rate of preventable trauma death to the 2020. The final goal is to set up the trauma care system to achieve zero preventable deaths rate after injury in the future. Trauma care system in Korea was started since 2012. Optimal trauma care systems have the potential to significantly reduce trauma-related mortality. For patients with severe injuries, getting care at a trauma center lowers the risk of mortality by 15-25%. Mission of trauma care is the right patient should have treated in the right place within the right time. Within the whole process, the patient should have right treatment. Trauma care system should have regionalization and well coordination in each stakeholder, and also the trauma care stakeholders should have accountability. An optimal trauma care system provides care with a well-functioning, comprehensive system from pre-hospital trauma care through the rehabilitation stages. A trauma care system should also include disaster preparedness and education and training to the public, and to paramedics and trauma-related medical personnel. An optimal trauma care system will give the right treatment to the right patients at the right place and time. The components of optimal trauma systems include trauma center designation; the existence of trauma advisory groups; trauma registry use for quality control; current field triage guidelines; trauma system involvement in emergency preparedness planning; and national funding sources. Korean government has designated 17 regional trauma centers by 2017 which have 2 exclusive models of trauma center and 15 inclusive models of trauma center. HEMS (Helicopter Emergency Medical Services) system is also very important for optimal trauma care. HEMS in Korea started from 2011. So Ministry of Health and Welfare launched 6 EMS helicopters since 2012. With six EMS helicopters, it is impossible for the whole nation to be treated within one Golden Hour after injury. I would like to discuss the present and future's perspective of trauma care system in Korea.

# Directions of Military Trauma System Innovation (What Should We Focused on Military Trauma System Innovation?)

**Byung Seop Choi, MD**

Office of the Surgeon General (OTSG), Army Headquarters, Korea

75-90% of all combat deaths occur before the casualty reaches a medical treatment facility. Three most common causes of preventable death on the battlefield are hemorrhage from extremity wounds, tension pneumothorax and airway problems. Technologic researches and developments of military trauma have been developed in the direction to halt these preventable deaths.

The objectives of new technologies in military trauma is to provide requirements driven combat casualty care medical solutions and products for injured soldiers from self-aid through definitive care across the full spectrum of military operations. New innovations and technologies of military trauma care should be focused on the medicine that can be used on combat casualties care in battlefield.

If the casualty does not arrive alive at definitive care facility, then the surgeons' skill can't help. The goal of military trauma medicine is to identify and treat those casualties with preventable causes of death and keep them alive long enough to reach the hospital. But, we don't have enough time, supplies and medical personnel on battlefield. So, the fate of the injured often lies in the hands of the one who provides the first care to the casualty in battlefield. For this reason, continuous researches and developments of new technologies that can be used on the scene are essential to life-saving efforts for combat casualties.

## Oral Session 2: Nutrition

**Session Director**

Gil Jae Lee (Gachon University, Korea)

**Moderator**

Dong Woo Shin (Hallym University, Korea)

Do Joong Park (Seoul National University, Korea)

- 
- Energy and Protein Requirement in Severe Trauma Patients
  - Nutritional Support in TBI Patients
  - Oral Presentation (OP2)



# Energy and Protein Requirement in Severe Trauma Patients

**Chi-Min Park**

Sungkyunkwan University, Korea

Nutrition therapy in severe trauma patients is one of essential parts of trauma care. Because malnutrition or suboptimal nutrition therapy is associated with poor clinical outcomes, many physicians usually provide full target energy. Additionally, because of many benefit of enteral nutrition, many clinical guidelines recommend early enteral nutrition for trauma patients. However, it is uncertain that how many calories and protein should be needed to achieving these benefits of nutrition therapy. Furthermore, full energy feeding remain one of the high risk factors for aspiration, which represents the leading cause of pneumonia in the ICU and aggressive nutrition support can result in overfeeding that can have serious negative effects. Therefore physician should try to provide optimal energy and protein calories to all severe trauma patients according to the clinical condition and exact assessment.

# Nutritional Support in TBI Patients

**Bo-Ra Seo, MD**

Department of Neurosurgery, Mokpo Hankook Hospital, Korea

The complex interaction of the body with nutritional support is magnified during illness, particularly after severe traumatic brain injury (TBI). Seminal work from the 1980s demonstrated that severe TBI was associated with increased energy expenditure early after injury. The presumption has been that the TBI itself causes an intrinsic increase in metabolism and requirement for caloric support—likely from a centrally mediated mechanism that is still unknown. More recent evidence suggests that contemporary neurocritical care may blunt this response, but these studies underscore the complex interactions that are in play simply in determining how many calories should be administered to patients with severe TBI. Similarly, it has long been known that an increase in serum glucose is observed after severe stress, including severe TBI. Studies from other critical illnesses have demonstrated that controlling this response with the use of insulin can lead to significant improvements in outcomes of critically ill patients.

There are a number of questions that must be addressed for comprehensive guidance on nutritional support. How many calories are required for optimal recovery? What is the optimal method of administering these calories (enterally/parenterally/both)? When should this support start? What should the composition of such support include with regard to carbohydrates, proteins, and lipids? Are there nutritional supplements that might play a role in improved recovery? What is the role of insulin in controlling serum glucose concentrations in this vulnerable patient population? Can specialized diets play a role in the care of the patient with severe TBI?

In this presentation, the author mentions all of these questions but, the literature review don't give us a definite answer and it underscore the need for more research on nutrition and severe TBI.

## Effect of Early Enteral Nutrition on the Incidence of Acute Acalculous Cholecystitis among Trauma Patients

Ye Rim Chang, Jung Ho Yun, Dong Hun Kim, Jeongseok Yun,  
Seok Won Lee, Sung Wook Chang, Han Cheol Jo, and Seok Ho Choi

Trauma Center, Dankook University Hospital, Cheonan, Korea

### Objective

Early enteral nutrition (EN) has been shown a significant reduction in morbidity and mortality compared to other nutritional support. Multistrategy nutritional protocol was implemented through 2016 for early EN and proper nutritional support in the intensive care unit (ICU). Acute acalculous cholecystitis (AAC), a serious and potentially lethal condition, often occurs in critically ill patients, especially related to trauma, surgery, shock, and prolonged fasting. Therefore, this study aimed to evaluate the effect of early EN on the incidence of AAC among trauma patients.

### Methods

The traumatized, critically-ill patients without volitional intake who were admitted to ICU of Dankook University Hospital between 2015 and 2017 were included. Basic characteristics, incidence of percutaneous cholecystostomy (PC) due to AAC according to each year and duration of fasting was analyzed.

### Results

EN were indicated in 552 patients (28.2%) among 1,957 TICU patients. The mean age of overall study subjects were 60.2 years and male consisted 78.3%. Mean injury severity score was 24.0 and 77.5% had head injuries. Basic characteristics were not different according to the year, however, mean duration of fasting was shortened from 6.5 days on 2015 to 5.4 days on 2017 ( $p=0.202$ ). Incidence of PC were significantly decreased according to the year [6/171 (3.5%) vs. 6/204 (2.9%) vs. 0/177 (0%),  $p=0.023$ ]. When duration of fasting was shorter than 7 days, incidence of PC was significantly decreased [5/412 (1.2%) vs. 7/140 (5.0%),  $p=0.014$ ]. Mean length of hospital stay also decreased from 30.1 days on 2015 to 27.7 days on 2017 ( $p=0.001$ ).

### Conclusion

This study showed the incidence of PC due to AAC were decreased significantly after the implementation of nutritional protocol for early EN among traumatized, critically ill patients. Early EN seems effective in reducing the AAC among trauma patients who are high risk of AAC.

## Nutritional Support after Emergency GI Surgery

Gil Jae Lee

Gachon University Gil Medical Center, Korea

Nutritional support after emergency gastrointestinal surgery plays important role in wound healing and postoperative recovery. Early enteral feeding has many advantages, however patients with emergency bowel surgery have an edematous or ischemic bowel. Therefore most surgeons are careful to eat early after an emergency GI operation.

In the case of emergency gastrointestinal surgery, proper nutrition is more important, but there is no clinical guideline in Korea. The purpose of this study was to identify the current status of patients with emergency gastrointestinal surgery and to investigate the actual nutritional status.

Compared with the general nutritional supply guidelines, it will be a basic study and research for the development of the guidelines that more closely match the nutritional needs of patients with emergency gastrointestinal surgery.

Between 1 January and 31 December 2016, we collected retrospective data for 13 tertiary hospitals and investigated that the cause of emergency gastrointestinal surgery (trauma, non-traumatic disease), operation type, nutritional status, calorie and nutrient types supplied after operation, feeding route and period, nutritional evaluation method, and whether they received consultation by nutritional support team.

## Luncheon Seminar 1

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Jae Gil Lee (Yonsei University, Korea)

- 
- Clinical Role of Moxifloxacin in cIAI and cSSSI



# Clinical Role of Moxifloxacin in cIAI and cSSSI

Ja-cob Lee

Hallym University, Korea

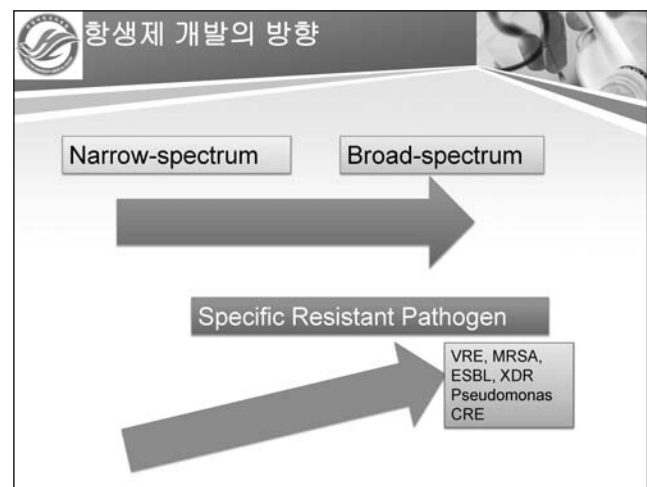
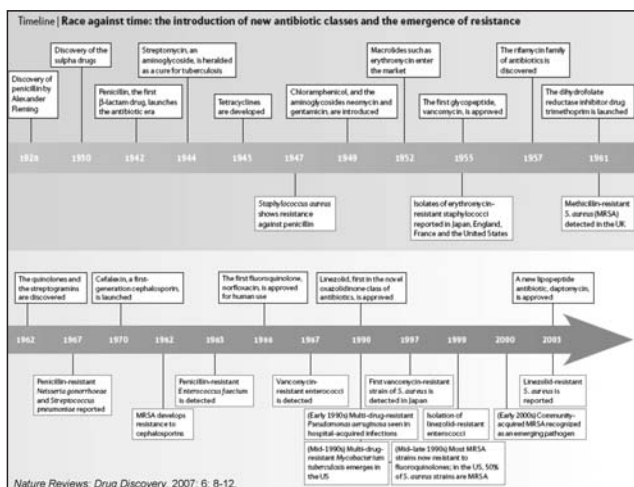


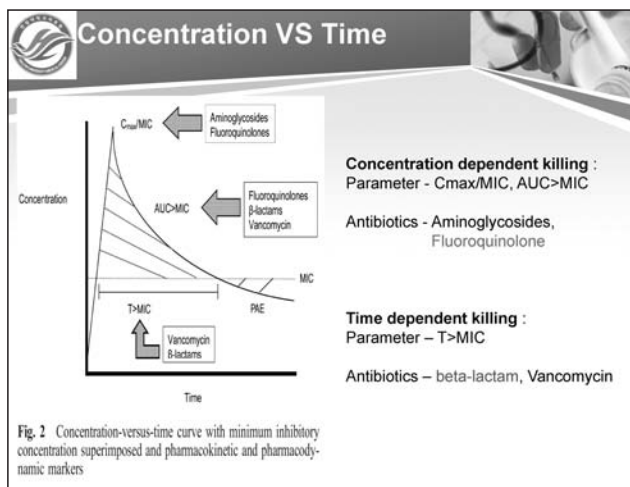
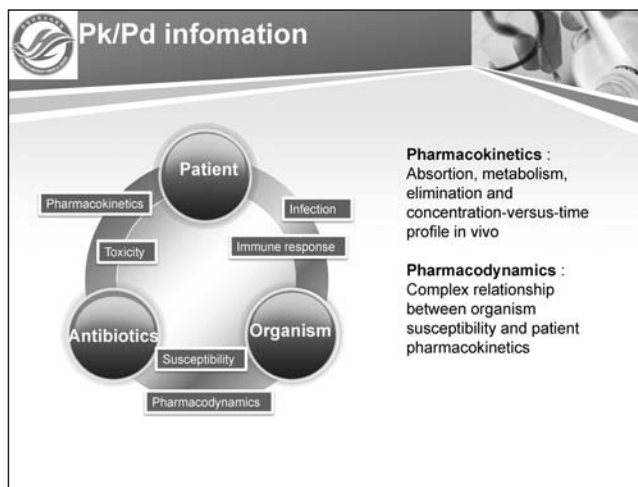
Moxifloxacin(Avelox)  
Skin and soft tissue infection  
Complicated intraabdominal infection

한림대학교 강남성심병원  
감염내과 이재갑



항생제 사용의 기본원칙



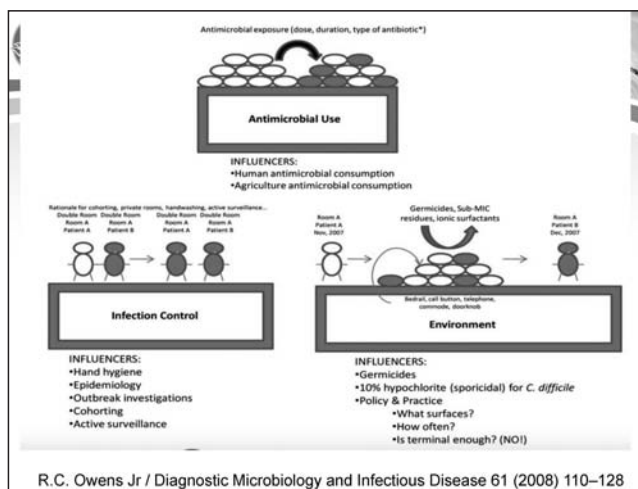


### Activity of Broad Spectrum Agents

	MRSA/ VRE	Gram (+)	Gram (-)	ESBL + G(-)	anaerobe	Pseudomonas/ acinetobacter
Ertapenem						
Carbapenem						
Piperacillin/ tazoctam						
3 <sup>rd</sup> cephalosporin						
Quinolone						
Tigecycline						

### Selection risk of major antibiotics

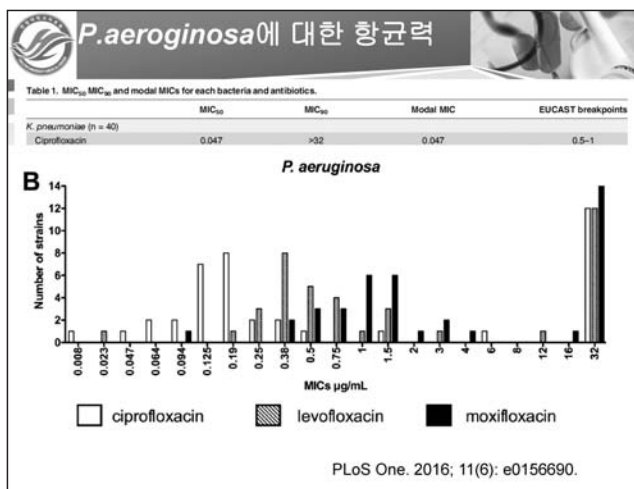
	MRSA	VRE	ESBL/CRE	MDR Pseudo	MDR acinetobacter	C.difficile
Ertapenem				?	?	
Carbapenem						
Piperacillin/ tazoctam						
3 <sup>rd</sup> cephalosporin						
Quinolone						
tigecycline				?	?	



Quinolone						
G(+), G(-), Pseudomonas intra-cellular organism						
	대표적인 약	폐렴	요로감염	복강내감염	SSTI	Pseudomonas
1세대	Nalidixic acid					
2세대	Ciprofloxacin	-	+	+	-	+
3세대	Levofloxacin	+	+	+	+	+
4세대	Moxifloxacin	+	-	+	+	+/-

감수성 - 그람 양성/음성균				
Methicillin-susceptible <i>S. aureus</i> (40)				
Ciprofloxacin	0.5-2.0	0.5	2.0	80
<i>Streptococcus</i> spp. (30) <sup>b</sup>				
<i>E. coli</i> (100)				
<i>Klebsiella pneumoniae</i> (40)				
Ciprofloxacin	≤0.03-1.0	0.06	0.12	100
Moxifloxacin	0.06-2.0	0.25	1.0	100
Gatifloxacin	0.06-2.0	0.5	2.0	100
Levofloxacin	≤0.03-1.0	0.06	0.25	100
Piperacillin-tazobactam	0.12-64.0	1.0	8.0	90
Imipenem	≤0.03-1.0	0.12	0.5	100

Antimicrobial agents and chemotherapy. 2004;48(3):1012-1016.



**Moxifloxacin**

**Acute Bacterial Sinusitis** caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, or *Moraxella catarrhalis*.

**Acute Bacterial Exacerbation of Chronic Bronchitis** caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Haemophilus parainfluenzae*, *Klebsiella pneumoniae*, methicillin-susceptible *Staphylococcus aureus*, or *Moraxella catarrhalis*.

**Community Acquired Pneumonia** caused by *Streptococcus pneumoniae* (including multi-drug resistant strains\*), *Haemophilus influenzae*, *Moraxella catarrhalis*, methicillin-susceptible *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Mycoplasma pneumoniae*, or *Chlamydia pneumoniae*.

\* MDRSP, Multi-drug resistant *Streptococcus pneumoniae* includes isolates previously known as PRSP (Penicillin-resistant *S. pneumoniae*), and are strains resistant to two or more of the following antibiotics: penicillin (MIC  $\geq 2 \mu\text{g/mL}$ ), 2<sup>nd</sup> generation cephalosporins (e.g., cefuroxime), macrolides, tetracyclines, and trimethoprim/sulfamethoxazole.

**Uncomplicated Skin and Skin Structure Infections** caused by methicillin-susceptible *Staphylococcus aureus* or *Streptococcus pyogenes*.

**Complicated Intra-Abdominal Infections** including polymicrobial infections such as abscess caused by *Escherichia coli*, *Bacteroides fragilis*, *Streptococcus anginosus*, *Streptococcus constellatus*, *Enterococcus faecalis*, *Proteus mirabilis*, *Clostridium perfringens*, *Bacteroides thetaiotaomicron*, or *Peptostreptococcus* species.

**Complicated Skin and Skin Structure Infections** caused by methicillin-susceptible *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, or *Enterobacter cloacae*.

**Moxifloxacin**

**Skin and Soft tissue Infection**

SSTI에 대한 임상연구			
	Antibiotics	Clinical cure rate %	비고
Uncomplicated SSTI <sup>1</sup>	Moxifloxacin PO Cephalexin PO	90 : 91	<i>S. aureus</i> 92 : 93 <i>Strep</i> 92 : 82
Complicated SSTI <sup>2</sup> (미국)	Moxi IV->PO Beta-lactam/inhibitor	77.2 : 81.5	<i>S. Aureus</i> : 82.2 : 87.6 <i>E. coli</i> : 81.6 : 84.8
Complicated SSTI <sup>2</sup> (대한민국)	Moxi IV->PO Beta-lactam/inhibitor	80.6 : 84.5	<i>K. Pneumoniae</i> : 91.7 : 70.0 <i>E. Cloacae</i> : 81.8 : 57.1
Complicated SSTI <sup>3</sup>	Moxi IV->PO Pip-Tazo	79 : 82	Abscess : 79 : 93

1. Parish et al 2000; 2. Anonymous 2005; 3. Giordano et al 2005.

*J Antimicrob Chem*

95% CI: -5.3, 3.9  
P=0.758

95% CI: -3.8, 6.3  
P=0.632

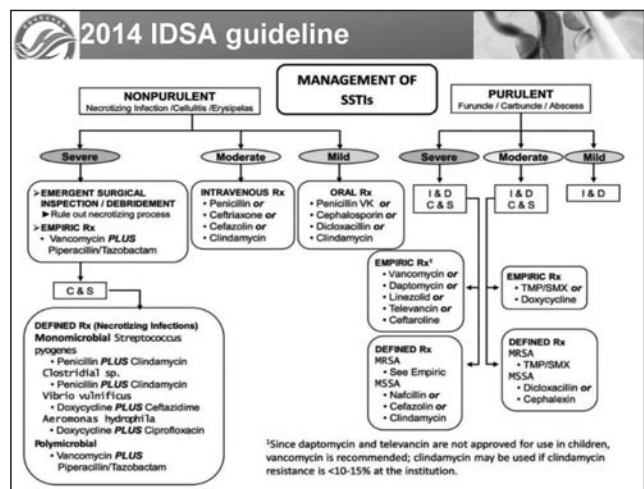
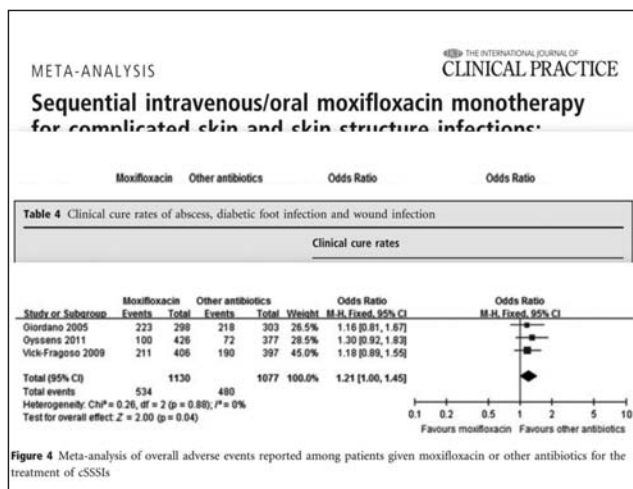
**Table 4.** Clinical success at TOC by diagnosis (PP and ITT populations), as assessed by the DRC

	PP			ITT		
	maxifloxacin (N=361)	TZP-AMC (N=307)	estimate: 95% CI	maxifloxacin (N=426)	TZP-AMC (N=377)	estimate: 95% CI
All patients	320/361 (88.6)	275/307 (89.6)	-0.72; -5.3, 3.9	350/426 (82.2)	305/377 (80.9)	1.25; -3.8, 6.3
Diagnosis						
major abscess	160/167 (95.8)	147/153 (96.1)	0.2; -4.2, 4.5	163/183 (89.1)	151/169 (89.3)	0.8; -5.6, 7.2
diabetic foot infection	84/110 (76.4)	75/96 (78.1)	-2.8; -14.5, 9.0	86/123 (69.9)	76/110 (69.1)	-0.1; -12.4, 12.1
wound infection	59/62 (95.2)	45/47 (95.7)	-1.4; -9.7, 6.8	65/72 (90.3)	48/55 (87.3)	2.3; -8.6, 13.2
infected ischaemic ulcer	17/22 (77.3)	8/11 (72.7)	6.2; -27.2, 39.6	17/24 (70.8)	9/18 (50.0)	20.1; -9.0, 49.2

n/N, number of patients experiencing clinical cure/number of patients with a given diagnosis.

Diagnosis	Effectiveness rating (%)			
	Very good	Good	Sufficient	Insufficient
All diagnoses	64.1	26.8	5.5	3.3
Post-surgical wound infection	67.4	24.6	5.6	2.4
Skin abscess	69.6	24.9	2.9	1.9
Diabetic foot infection	50.9	31.7	9.9	7.1
Erysipelas/cellulitis	67.8	25.9	3.3	2.9
Post-traumatic wound infection	67.3	26.7	4.5	1.4
Bite wound infections	67.5	28.6	3.2	0.6
Infected ulcer	50.6	35.8	9.9	2.5
Other infections	60.1	24.9	7.8	6.7

Adverse events (AE)	Patients, n (%)
All AEs	144 (2.6)
ADRs	110 (2.0)
Serious AEs	27 (0.5)
Serious ADRs*	8 (<0.2)
Permanent discontinuation of therapy due to AE	55 (1.0)
AEs with fatal outcome	13 (0.2)
ADRs with fatal outcome	2 (<0.1)



**2014 IDSA Surgical Site Infection**

**Surgery of Intestinal or Genitourinary Tract**

**Single-drug regimens**

- Ticarcillin-clavulanate 3.1 g every 6 h IV
- Piperacillin-tazobactam 3.375 g every 6 h or 4.5 g every 8 h IV
- Imipenem-cilastatin 500 mg every 6 h IV
- Meropenem 1 g every 8 h IV
- Ertapenem 1 g every 24 h IV

**Combination regimens**

- Ceftriaxone 1 g every 24 h + metronidazole 500 mg every 8 h IV
- Ciprofloxacin 400 mg IV every 12 h or 750 mg po every 12 h + metronidazole 500 mg every 8 h IV
- Levofloxacin 750 mg IV every 24 h + metronidazole 500 mg every 8 h IV
- Ampicillin-sulbactam 3 g every 6 h + gentamicin or tobramycin 5 mg/kg every 24 h IV

**2014 IDSA Surgical Site Infection**

**Surgery of trunk or extremity away from axilla or perineum**

- Oxacillin or nafcillin 2 g every 6 h IV
- Cefazolin 0.5-1 g every 8 h IV
- Cephalexin 500 mg every 6 h po
- SMX-TMP 160-800 mg po every 6 h
- Vancomycin 15 mg/kg every 12 h IV

**Surgery of axilla or perineum\***

- Metronidazole 500 mg every 8 h IV
- plus
- Ciprofloxacin 400 mg IV every 12 h or 750 mg po every 12 h IV po
- Levofloxacin 750 mg every 24 h IV po
- Ceftriaxone 1 g every 24 h

2014 IDSA Animal/Human bite		
<b>Animal bite</b>		
Amoxicillin-clavulanate	875/125 mg bid	...
Ampicillin-sulbactam	...	1.5–3.0 g every 6–8 h
Piperacillin-tazobactam	...	3.37 g every 6–8 h
Carbapenems	...	See individual info
Doxycycline	100 mg bid	100 mg every 12 h
Penicillin plus dicloxacillin	500 mg qid/500 mg qid	...
SMX-TMP	160–800 mg bid	5–10 mg/kg/day of TMP component
Metronidazole	250–500 mg tid	500 mg every 8 h
Clindamycin	300 mg tid	600 mg every 6–8 h
<b>Second-generation cephalosporin</b>		
Cefuroxime	500 mg bid	1 g every 12 h
Cefoxitin	...	1 g every 6–8 h
<b>Third-generation cephalosporin</b>		
Ceftriaxone	...	1 g every 12 h
Cefotaxime	...	1–2 g every 6–8 h
<b>Fluoroquinolones</b>		
Ciprofloxacin	500–750 mg bid	400 mg every 12 h
Levofloxacin	750 mg daily	750 mg daily
Moxifloxacin	400 mg daily	400 mg daily
<b>Human bite</b>		
Amoxicillin-clavulanate	875/125 mg bid	...
Ampicillin-sulbactam	...	1.5–3.0 g every 6 h
Carbapenems	...	...
Doxycycline	100 mg bid	...

## 2017 KSID guideline

**Special Article**  
<https://doi.org/10.3947/ic.2017.49.4.301>  
 Infect Chemother 2017;49(4):301-325  
 ISSN 2093-2340 (Print) · ISSN 2092-6448 (Online)

### Clinical Guidelines for the Antibiotic Treatment for Community-Acquired Skin and Soft Tissue Infection

Yee Gyung Kwak<sup>1,2\*</sup>, Seong-Ho Choi<sup>1,4\*</sup>, Tark Kim<sup>1,5\*</sup>, Seong Yeon Park<sup>1,6\*</sup>, Soo-Hong Seo<sup>7,8</sup>, Min Bom Kim<sup>9,10</sup>, Sang-Ho Choi<sup>2,11</sup>

2017 KSID Erysipelas/Cellulitis		
Causative bacteria	Antibiotic	Adult dose
<i>Streptococcus</i>	Penicillin	2–4 million units q4–6 h IV
	Nafcillin	1–2 g q4–6 h IV
	Ampicillin/sulbactam	1.5–3 g q6 h IV
	Amoxicillin	500 mg q 12 h PO or 250 mg q8 h PO
	Cefazolin	1–2 g q8 h IV
	Cephalexin	500 mg q6 h PO
	Cephadrine	500 mg q6 h PO
	Cefadroxil	500–1,000 mg q12–24 h
	Clindamycin	600–900 mg q8 h IV or 300–450 mg qid PO
	Doxycycline	100 mg bid PO
Methicillin-susceptible <i>Staphylococcus aureus</i>	Nafcillin	1–2 g q4 h IV
	Cefazolin	1–2 g q8 h IV
	Cephalexin	500 mg q6 h PO
	Cephadrine	500 mg q6 h PO
	Cefadroxil	500–1,000 mg q12–24 h
Methicillin-resistant <i>Staphylococcus aureus</i>	Vancomycin	15 mg/kg q12 h IV
	Linezolid	600 mg every 12 h IV or 600 mg bid PO
	Clindamycin	600 mg every 8 h IV or 300–450 mg qid PO
	Doxycycline	100 mg bid PO
	Trimethoprim/sulfamethoxazole	1–2 double-strength tablets bid PO

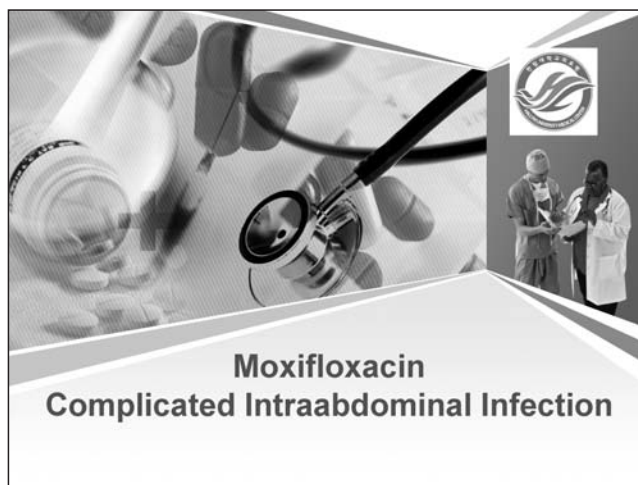
2017 KSID Necrotizing fascitis		
Disease classification	Antibiotic	Adult dose
Empirical therapy	Tricoplanin or vancomycin or linezolid	6–12 mg/kg q24 h IV 15 mg/kg q12 h IV 600 mg q12 h IV
	plus piperacillin/tazobactam or ertapenem or meropenem or imipenem or ceftazidime plus metronidazole	3.375–4.5 g q8 h IV 1 g q24 h IV 1 g q8 h IV 500 mg q6 h IV 2 g q8 h IV 500 mg q8 h IV
<i>Streptococcus</i>	Penicillin plus clindamycin	2–4 million units q4–6 h IV 600–900 mg q8 h IV
Methicillin-susceptible <i>Staphylococcus aureus</i>	Nafcillin or cefazolin	1–2 g q4 h IV 1–2 g q8 h IV
Methicillin-resistant <i>Staphylococcus aureus</i>	Vancomycin or tricoplanin or linezolid	15 mg/kg q12 h IV 6–12 mg/kg q24 h IV 600 mg q12 h IV
<i>Aeromonas hydrophila</i>	Ciprofloxacin or ceftazidime or ceftriaxone plus doxycycline	400 mg q12 h IV 2 g q8 h IV 2 g q24 h IV 100 mg bid PO
<i>Vibrio vulnificus</i>	Cefotaxime or ceftriaxone plus doxycycline	2 g q8 h IV 2 g q24 h IV 100 mg bid PO

2017 KSID pyomyositis		
Disease classification	Antibiotic	Adult dose
Empirical therapy	Ampicillin/sulbactam or ceftazidime or piperacillin/tazobactam or ertapenem	3 g q6 h IV 2 g q8 h IV 3.375–4.5 g q6–8 h IV 1 g q24 h IV
	plus clindamycin	600–900 mg q8 h IV
<i>Streptococcus</i>	Penicillin	2–4 million units q4–6 h IV
Methicillin-susceptible <i>Staphylococcus aureus</i>	Nafcillin or cefazolin	1–2 g q4 h IV 1–2 g q8 h IV
Methicillin-resistance <i>Staphylococcus aureus</i>	Vancomycin or teicoplanin or linezolid	15 mg/kg q12 h IV 6–12 mg/kg q24 h IV 600 mg q12 h IV

IV, intravenous; PO, per os.

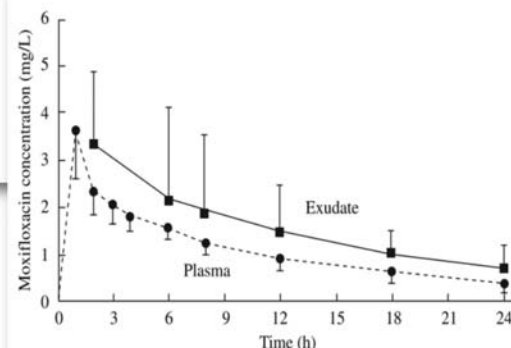
2017 KSID animal bite/human bite		
Classification	Antibiotic	Adult dose (normal kidney function)
Drug of choice	Amoxicillin/clavulanate	875/125 mg bid PO
	Ampicillin/sulbactam	1.5–3.0 g q6–8 h IV
	Piperacillin/tazobactam	3.375–4.5 g q6–8 h IV
	Ceftriaxone or Cefotaxime	2 g q24 h IV 1–2 g q6–8 h IV
	plus Metronidazole or Clindamycin	500 mg q8 h IV or 250–500 mg tid PO 600 mg q6–8 h IV or 300 mg tid PO
	Cefoxitin	1 g q6–8 h IV
	Ertapenem	1 g q24 h IV
	Moxifloxacin	400 mg q24 h IV or PO
	Doxycycline	100 mg bid PO
	Ciprofloxacin or Levofloxacin	400 mg q12 h IV or 500–750 mg bid PO 750 mg q24 h IV or PO
Alternatives	Trimethoprim-sulfamethoxazole or Cefuroxime	TMP 5–10 mg/kg/day IV or 160–800 mg bid 1 g q12 h IV or 500 mg bid PO
	plus Metronidazole or Clindamycin	500 mg q8 h IV or 250–500 mg tid PO 600 mg q6–8 h IV or 300 mg tid PO

PO, per os; IV, intravenous.



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doi:10.1093/jac/dkl305

JAC



Organism	Bacteriologic Eradication [n/N (%)]*	
	Moxifloxacin (150 patients)	Comparator (163 patients)

**TABLE 7. Overview of Most Common Adverse Events Due to Any Cause (Occurrences  $\geq 10$  Patients in Either Group)**

Adverse Event	Moxifloxacin (329 patients) [n (%)]	Comparator (327 patients) [n (%)]
Nausea	57 (17)	37 (11)
Constipation	44 (13)	33 (10)
Hypokalemia	40 (12)	39 (12)
Abdominal pain	36 (11)	42 (13)
Insomnia	31 (9)	36 (11)
Anemia	28 (9)	36 (11)
Diarrhea	27 (8)	39 (12)

Polymicrobial infections	20/24 (83)	30/34 (88)
Monomicrobial infections	97/126 (77)	96/129 (74)

Organism	No. of patients with organism at baseline <sup>a</sup>		Bacteriological success	
	Moxifloxacin (N=132)	Ceftriaxone/metronidazole (N=123)	Moxifloxacin [n (%)]	Ceftriaxone/metronidazole [n (%)]

**Gram-negative aerobes**

<i>Escherichia coli</i> (non-ESBL)	75	80	68 (90.7)	77 (96.3)
<i>E. coli</i> (ESBL-producers)	25	16	23 (92.0)	14 (87.5)
<i>Klebsiella pneumoniae</i> (non-ESBL)	14	17	14 (100)	15 (88.2)
<i>Pseudomonas aeruginosa</i>	18	13	16 (88.9)	11 (84.6)
<i>Klebsiella oxytoca</i> (non-ESBL)	6	3	6 (100)	3 (100)
<i>Proteus vulgaris</i>	7	0	7 (100)	0
<i>Enterobacter cloacae</i>	3	5	3 (100)	5 (100)
<i>Comamonas testosteroni</i>	9	8	9 (100)	8 (100)

**Gram-negative anaerobes**

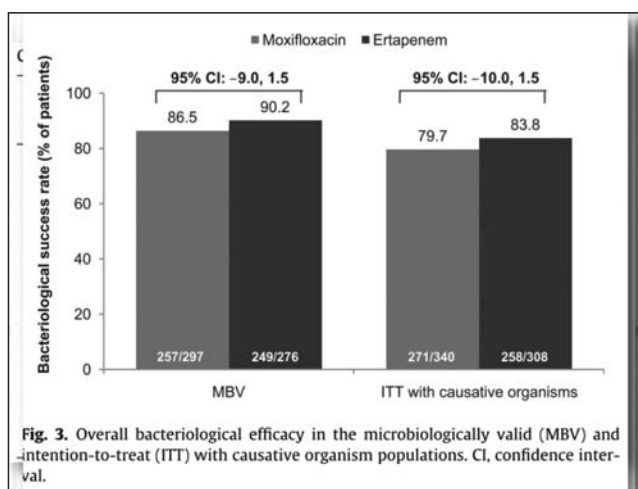
<i>Bacteroides fragilis</i>	27	26	23 (85.2)	25 (96.2)
<i>Bacteroides thetaiotaomicron</i>	10	7	9 (90.0)	7 (100)
<i>Bacteroides uniformis</i>	6	2	5 (83.3)	1 (50.0)

**Gram-positive aerobes**

<i>Streptococcus spp.</i>	1	5	1 (100)	5 (100)
<i>Streptococcus mitis</i>	6	1	5 (83.3)	1 (100)
<i>Streptococcus constellatus</i>	5	3	5 (100)	3 (100)
<i>Enterococcus faecium</i>	6	3	6 (100)	3 (100)
<i>Enterococcus faecalis</i>	8	5	7 (87.5)	4 (80.0)

**Gram-positive anaerobes**

<i>Eubacterium lentum</i>	10	5	8 (80.0)	5 (100)
<i>Peptostreptococcus anaerobius</i>	8	1	8 (100)	0



**2009 IDSA guideline**

**Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America**

Joseph S. Solomkin,<sup>1</sup> John E. Mazuski,<sup>1</sup> John S. Bradley,<sup>1</sup> Keith A. Rodvold,<sup>1\*</sup> Ellie J. C. Goldstein,<sup>1</sup> Ellen J. Baron,<sup>1</sup> Patrick J. O'Neill,<sup>1</sup> Anthony W. Chow,<sup>1</sup> E. Patchen Dellinger,<sup>2</sup> Soumitra R. Eachempati,<sup>3</sup> Sherwood Gorbach,<sup>4</sup> Mary Hilliker,<sup>5</sup> Addison K. May,<sup>6</sup> Avery B. Nathens,<sup>7</sup> Robert G. Sawyer,<sup>8</sup> and John G. Bartlett<sup>9</sup>

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2009 IDSA Community-acquired			
Community-acquired infection in adults			
Regimen	Community-acquired infection in pediatric patients	Mild-to-moderate severity: perforated or abscessed appendicitis and other infections of mild-to-moderate severity	High risk or severity: severe physiologic disturbance, advanced age, or immunocompromised state
Single agent	Ertapenem, meropenem, imipenem-cilastatin, ticarcillin-clavulanate, and piperacillin-tazobactam	Cefoxitin, ertapenem, moxifloxacin, tigecycline, and ticarcillin-clavulanate acid	Imipenem-cilastatin, meropenem, doripenem, and piperacillin-tazobactam
Combination	Ceftriaxone, cefotaxime, cefepime, or ceftazidime, each in combination with metronidazole; gentamicin or tobramycin, each in combination with metronidazole or clindamycin, and with or without ampicillin	Cefazolin, cefuroxime, ceftriaxone, cefotaxime, ciprofloxacin, or levofloxacin, each in combination with metronidazole <sup>a</sup>	Cefepime, ceftazidime, ciprofloxacin, or levofloxacin, each in combination with metronidazole <sup>a</sup>

<sup>a</sup> Because of increasing resistance of *Escherichia coli* to fluoroquinolones, local population susceptibility profiles and, if available, isolate susceptibility should be reviewed.

2009 IDSA Health care associated					
Regimen					
Organisms seen in health care-associated infection at the local institution	Carbapenem <sup>a</sup>	Piperacillin-tazobactam	Ceftazidime or cefepime, each with metronidazole	Aminoglycoside	Vancomycin
<20% Resistant <i>Pseudomonas aeruginosa</i> , ESBL-producing <i>Enterobacteriaceae</i> , <i>Acinetobacter</i> , or other MDR GNB	Recommended	Recommended	Recommended	Not recommended	Not recommended
ESBL-producing <i>Enterobacteriaceae</i>	Recommended	Recommended	Not recommended	Recommended	Not recommended
<i>P. aeruginosa</i> >20% resistant to ceftazidime	Recommended	Recommended	Not recommended	Recommended	Not recommended
MRSA	Not recommended	Not recommended	Not recommended	Not recommended	Recommended

2009 IDSA Biliary tract	
Infection	Regimen
Community-acquired acute cholecystitis of mild-to-moderate severity	Cefazolin, cefuroxime, or ceftriaxone
Community-acquired acute cholecystitis of severe physiologic disturbance, advanced age, or immunocompromised state	Imipenem-cilastatin, meropenem, doripenem, piperacillin-tazobactam, ciprofloxacin, levofloxacin, or cefepime, each in combination with metronidazole <sup>a</sup>
Acute cholangitis following biliary-enteric anastomosis of any severity	Imipenem-cilastatin, meropenem, doripenem, piperacillin-tazobactam, ciprofloxacin, levofloxacin, or cefepime, each in combination with metronidazole <sup>a</sup>
Health care-associated biliary infection of any severity	Imipenem-cilastatin, meropenem, doripenem, piperacillin-tazobactam, ciprofloxacin, levofloxacin, or cefepime, each in combination with metronidazole, vancomycin added to each regimen <sup>a</sup>

2010 KSID Community-acquired CIAI	
Table 11. Empirical Antibiotics Recommendation in Community Acquired Complicated intraabdominal Infection	
Mild-to-moderate severity	High severity
Cefoxitin (A-II)	Ceftazidime or cefepime + metronidazole (A-I)
Cefuroxime+metronidazole (A-II)	Piperacillin/tazobactam (A-I)
Ceftriaxone or cefotaxime+metronidazole (A-II)	Imipenem/cilastatin (A-I)
Ciprofloxacin or levofloxacin +metronidazole (A-II)	Meropenem (A-I)
Ertapenem (B-II)	
Moxifloxacin (B-II)	
Tigecycline (B-II)	

2010 KSID Health care-Associated CIAI	
(3) 의료관련 복잡성 복강내 감염 환자의 경험적 항생제는 무엇인가?	
23. 의료관련 복잡성 복강내 감염에 대한 경험적 항생제 치료는 각 병원의 역학에 따라 달라질 수 있다(A-II).	
24. 다음의 항생제를 사용할 수 있다: 항녹농균 효과가 있는 3세대 혹은 4세대 cephalosporins과 metronidazole 병합, piperacillin/tazobactam, meropenem, imipenem/cilastatin (B-III).	
25. Aminoglycoside 병합을 고려할 수 있다(B-III).	

결론	
<ul style="list-style-type: none"> <li>Moxifloxacin은 quinolone계 항생제로 그람양성균/음성균, 혐기성균에 항균력을 가지고 있다.</li> <li>하루 1회 투여가 가능하며 IV, 경구약제가 모두 있어 치료에 용이함이 있다.</li> <li>지역사회획득 피부연조직감염과 복강내감염에서 우수한 임상결과를 가지고 있다.</li> </ul>	



# Special Lecture Session 1: Future of Trauma in Korea

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Hun Joo Kim (Wonju Medical Center, Korea)

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

- 
- Developmental Planning of Korea Trauma Center
  - Plan of KTDB Utilization
  - Discussion



# Developmental Planning of Korea Trauma Center

**Hyun Min Cho**

Trauma Center, PNUH (Pusan National University Hospital), Korea

The purpose of this proposal is to suggest some resolutions to the problems associated with the trauma care system in Korea. From 2011 to 2017, all 17 level 1 trauma centers were designated throughout the country as already planned and 10 centers have been operating their own trauma facilities. At present, there are some differences in treatment experience and levels according to the time set forth and the type (independent or extended) of the trauma centers. Treating the trauma care system separately while they are simultaneously part of the rest of the emergency medical care system has become a serious problem in Korea. First of all, the role of trauma centers should be established before they are added to the trauma care system in a wide range of EMS (Emergency Medical System).

Beyond that, personnel are the most important factor in building a trauma center. Pusan National University Hospital (PNUH) offers the ideal environment for a study on the relationship between trauma centers and emergency centers. PNUH has 2 independent emergency rooms: one each in the trauma center and emergency center. Therefore, it is possible to compare the outcomes of 2 different emergency rooms and identify the proportion of the trauma population who is transferred from the emergency center to the trauma center due to the severity of trauma. Ultimately, the government setting up trauma system and the individual hospitals managing their workforce must support the trauma team administratively and financially to sustain trauma centers over the long term.

# Plan of KTDB Utilization

**Han Deok Yoon**

National Emergency Medical Center, Korea

# Management of Pediatric Unstable Pelvic Ring Injury: Panel Discussion

**Session Director**

Kyung Hag Lee (National Medical Center, Korea)

**Moderator**

Jong-Keon Oh (Korea University, Korea)

Oh Sang Kwon (Cheju Halla General Hospital, Korea)

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- Management of Pediatric Unstable Pelvic Ring Injury
- Panelist
  - Jong-Keon Oh (Korea University, Korea)
  - Min Bom Kim (Seoul National University, Korea)
  - Kyung Jin Oh (Chonnam National University, Korea)
  - Oh Sang Kwon (Cheju Halla General Hospital, Korea)



# Management of Pediatric Unstable Pelvic Ring Injury

**Jae-Woo Cho, MD**

Korea University Guro Hospital, Seoul, Korea

Pelvic and Acetabular fractures in children vary from simple apophyseal avulsion and stress fractures to high-energy unstable pelvic ring injuries that are life-threatening. Pelvic and acetabular fractures in the pediatric population are quite uncommon accounting for less than 1% of all pediatric fractures.

Pediatric pelvic and acetabular fractures differ in important ways from adult pelvic fractures.

1) Children in general have greater plasticity of the pelvic bone, increased elasticity of the SI joints and symphysis pubis, and thicker and stronger periosteum. Therefore, a relatively greater amount of energy can be dissipated before sustaining a pelvic fracture in a child as compared to an adult, and the relative force needed to sustain a pelvic fracture in a child is higher than in an adult.

2) The presence of the triradiate cartilage is another major difference. This critical physeal area is responsible for acetabular growth and development, acts as a stress riser in the pelvic ring, and is susceptible to permanent damage.

These important differences correlate with clinical outcomes. Children have a lower mortality rate associated with these injuries compared to adults and, when mortality occurs, it is more commonly related to associated injuries of the thorax, abdomen, and central nervous system rather than direct blood loss from the pelvic injury.

Unstable pelvic ring injuries may be a source of life-threatening hemorrhage in children. Coordinated management of multidisciplinary trauma team and careful treatment of the associated head and thoraco-abdominal injuries, in addition to pelvic ring fracture management, improve outcomes.

Although historically most pelvic fractures, including unstable injuries, were treated non-operatively, experience extrapolated from the care of adults with pelvic fractures has led to a growing movement to treat selected cases surgically in an attempt to decrease long-term disability.



## Oral Session 3: Infection

**Session Director**

Ye Rim Chang (Dankook University, Korea)

**Moderator**

Chi-Min Park (Sungkyunkwan University, Korea)

Suk-Kyung Hong (University of Ulsan, Korea)

- 
- Appropriate Choice and Duration of Antibiotics for Trauma Patients
  - Oral Presentation (OP3)



# Appropriate Choice and Duration of Antibiotics for Trauma Patients

**Kye-Hyung Kim, MD**

Pusan National University Hospital, Busan, Korea

Infectious complications are common in traumatic patients and cause significant morbidity and mortality. Wound infections in trauma patients occur because microorganisms, originated from external environments or leaked from internal organs, are inoculated into damaged tissues. To reduce infectious complications, cleaning, irrigation and disinfection of wounds are important. For contaminated wounds, antimicrobial prophylaxis is essential; however, a caretaker should choose prophylactic antibiotics carefully taking the types and locations of wounds and also the risk factors of the patients into consideration. Inappropriate and extended use of antibiotics is strongly associated with emergence of multi-drug resistant microorganisms due to the selection pressure on the microorganisms already colonizing the patients. This lecture will cover the literature review of appropriate choice and duration of prophylactic antibiotics in trauma patients.

## Factors Affecting Morbidity in Trauma Patients: A Propensity Score-matched Analysis

Ye Rim Chang, Jung Ho Yun, Sung Wook Chang, Dong Hun Kim,  
Jeongseok Yun, Seok Won Lee, Han Cheol Jo, Seok Ho Choi

Trauma Center, Dankook University Hospital, Cheonan, Korea

### Objective

This study aimed to investigate factors affecting morbidity in trauma patients using regional trauma database after correcting for selection bias through propensity score (PS) matching.

### Methods

We analyzed observational prospective data from the Dankook University Hospital Trauma Center Database between January, 2015 and September, 2017. To adjust for potential bias, we calculated the likelihood of morbidity via PS using age, sex, injury severity score (ISS), Glasgow Coma Scale (GCS) score. n

### Results

From 2,894 patients over ISS >8, a well-balanced propensity-matched cohort of 1,278 patients were defined. The mean age of overall study subjects was 63.3 years and male consisted 68.5%. Mean injury severity score was 18.0 and GCS score was 13.1. Mean length of hospital stay was 37.8 days. Regarding central line-related infection, only parenteral nutrition (PN) ( $p=0.047$ ) was significant risk factor in univariate analysis. Surgical site infection was associated with old age ( $p<0.001$ ; odds ratio [OR], 1.025; confidence interval [CI]; 1.013-1.037) and external organ injury ( $p<0.001$ ; OR, 2.872; CI, 1.695-4.865) in multivariate analysis. Morbidity was associated with abdominal organ injury ( $p=0.011$ ; OR, 1.419; CI, 1.083-1.860), external organ injury ( $p<0.001$ ; OR, 2.025; CI, 1.580-2.595), and provision of PN ( $p<0.001$ ; OR, 3.594; CI, 2.806-4.603).

### Conclusion

Patients with abdominal organ and external injury have high risk for morbidity in this PS matched analysis. Provision of PN was also associated with higher morbidity in concordance with current literatures and guidelines. PN would be provided only in adequate indication among trauma patients.

## 25 Cases of Unexpected Complications of Surgical Stabilization of Rib Fractures

Junepill Seok, Hyun Min Cho

Pusan National University Hospital

### Objective

To share our experiences of surgical stabilization of rib fractures, especially by presenting unexpected complications about surgical devices.

### Methods

Case-series.

### Conclusion

Except a few cases, most complications of plate and screw are preventable, and they are obviously technical failure. To reduce excessive tension, plates need to be bent following the shape of the ribs. Screws need to be drilled deep enough to penetrate opposite cortex. Lastly, surgeons should establish proper surgical indications. Surgical stabilization of rib fractures have been gaining medical evidences since past few decades, however, further studies are still required to explain its efficacy and appropriateness.

## Effectiveness on Wound Closure using Vacuum Assisted Closure Therapy for Patients Who Sustained High Velocity Gunshot Wounds: Case Series

Ralph Dennis Vicente, Domingo Chua jr

Armed Forces of the Philippines Victoriano Luna Medical Center

### Objective

#### a. General Objective

To assess the effectiveness on Wound Closure using Vacuum Assisted Closure Therapy for patients who sustained High Velocity Gunshot wounds admitted at the Department of Orthopedics and Traumatology Armed Forces of the Philippines Victoriano Luna Medical Center from Jan 2015 to Jan 2017.

#### b. Specific Objectives

- i. To assess the rate of wound size reduction from initial size of wound after debridement measured in centimeter square area in patients who underwent Vacuum Assisted Closure Therapy.
- ii. To measure the time of healing until wound closure measured in days from debridement to complete wound closure or skin grafting is done.
- iii. To detect bacterial growth by means of wound culture on wounds treated with Vacuum Assisted Closure Therapy.
- iv. To measure the demographics of patients who are military personnel who sustained high velocity gunshot wound and were treated with Vacuum Assisted Closure Therapy.

### Methods

Methodology: 22 patients who sustained high velocity gunshot wound admitted Department of Orthopedics and Traumatology Armed Forces of the Philippines Victoriano Luna Medical Center from Jan 2015 to Jan 2017. Variables that are studied include rate of granulation tissue, bacterial growth on wounds, and length of hospital stay.

### Results

During the VAC treatment period, There is a mean change of size of wound by  $35.59 \text{ cm}^2 \text{ SD} \pm 28.42$  Study presents VAC treatment decreases infection and Time from Debridement to wound closure (DAYS) averages 22.09 days  $\text{SD} \pm 6.64$ . Pain was assessed by VAS scoring. After treatment. There is a change of VAS score of  $3.5 \text{ SD} \pm 1.65$  and by Paired sample T-test 0.0001 there is significant difference of change in VAS score after treatment.

### Conclusion

To conclude, vacuum assisted closure helps in faster healing of High Velocity gun shot wounds. There is a significant improvement on VAS pain scale, infection control and decrease in hospital stay.

## Surgical Site Infections after Fracture Management with Hardware in Place

Gi Ho Moon<sup>2</sup>, Jong Keon Oh<sup>1</sup>, Jae Woo Jo<sup>1</sup>, Jin Kak Kim<sup>1</sup>, Do Hyun Yeo<sup>1</sup>, Beom Soo Kim<sup>1</sup>

<sup>1</sup>Korea University Guro Hospital, Seoul, Korea, <sup>2</sup>Republic of Korea Army Capital Hospital

### Objective

Identify the progress of the infection and associated factors through objective analysis of infection rate, treatment result and related factors after single center fracture surgery

### Methods

2015/01/01-2017/12/31 in Korea university GURO hospital, trauma team

Fracture patients / All patients : 1763 / 2157 (81.73%)

Single trauma center

2 orthopedic trauma experts

8 trauma specialized fellows

Definition

Multi site fracture : The fracture site was anatomically involved in two or more sites in AO classification

Isolated fracture : The fracture site was anatomically involved in one site in AO classification

Poly trauma patients : ISS score of 15 points or more regardless of fracture site

CNI : Culture does not grow bacteria but satisfies more than 2 criteria

Inclusion criteria (More than 2)

Sinus tract communicating with the implant

Elevated trend ESR and CRP

Pathogen is isolated by culture from tissue

Radiologic evidence of musculoskeletal infection (plain radiogram or MRI or CT)

### Results

Acute fracture surgery infections occurred in 35 operations during 1899 operations, accounting for 1.83%

The frequent site of infection was distal femur, tibial shaft, and pelvis. And the ratio of distal femur was the highest at 7.04%

The incidence of postoperative infection in lower extremity was 2.27%, which was higher than 0.87% in patients with upper extremity

The incidence of postoperative infection in polytrauma patients was 9.24%, which was higher than 1.46% in patients with one-site fracture

The incidence of postoperative infection in open fractures was 19.70%, which was higher than 1.20% in patients with closed fracture

### Conclusion

It is a data demonstrating a simple hypothesis that infection rates are high in patients with open fractures and multiple fractures

It is meaningful to be a single center data by trauma specialists

Fractures of the orthopedic area except the vertebrae were treated by the same trauma team

## Early Predictors for In-hospital Mortality in Elderly Trauma Patients

Jungyun Park, MD, Jae Gil Lee, MD, PhD, Seung Hwan Lee, MD

Department of Surgery, Yonsei University College of Medicine

### Objective

As the average life expectancy increases, the number of elderly trauma patients is dramatically increasing. Elderly patients have a high risk for mortality due to their comorbidities and vulnerabilities. The aim of the study is to identify early predictors for mortality in elderly trauma patients.

### Methods

We reviewed medical records of 971 trauma patients admitted between January 2013 and June 2016 and conducted a retrospective observational cohort study. Among these populations, total of 195 elderly patients 65 years old or older were finally included for the analysis. A multivariate logistic regression model was used to determine independent risk factors for the in-hospital mortality.

### Results

Multivariate analysis identified initial APACHE II score (Odds ratio (OR)=1.178, 95% confidence interval (CI)=1.066-1.302,  $p=0.001$ ), 24-hour lactate (OR=1.745, 95% CI=1.214-2.508,  $p=0.003$ ), SBP <90 mmHg (OR=0.006, 95% CI=0.001-0.285,  $p=0.009$ ), and pedestrian struck by a motor vehicle (OR=7.577, 95% CI=1.037-55.339,  $p=0.046$ ) as independent predictors for mortality.

### Conclusion

Higher APACHE II score, 24-hour lactate level, SBP <90 mmHg, and pedestrian struck by motor vehicle were found to be independent predictors for in-hospital mortality in elderly trauma patients. These predictors can help guide clinical decisions regarding the optimal treatment strategy in elderly trauma patients.

# Current Guidelines for Severe TBI

**Session Director**

Bo-Ra Seo (Mokpo Hankook Hospital, Korea)

**Moderator**

Dongkeun Hyun (Inha University, Korea)

Hee Jin Yang (Seoul National University, Korea)

- 
- Treatment
  - Monitoring and Thresholds
  - Discussion



# Treatment

**Namkyu You**

Ajou University School of Medicine, Korea

Based on [Guidelines for the Management of Severe Traumatic Brain Injury 4th Edition] - Sep 2016.

## 1. Decompressive Craniectomy

Bifrontal DC is not recommended to improve outcomes as measured by the Glasgow Outcome Scale-Extended (GOS-E) score at 6 months post-injury in severe TBI patients with diffuse injury.

## 2. Prophylactic Hypothermia

Early (within 2.5 hours), short-term (48 hours post-injury) prophylactic hypothermia is not recommended to improve outcomes in patients with diffuse injury.

## 3. Hyperosmolar Therapy

Although hyperosmolar therapy may lower intracranial pressure, there was insufficient evidence about effects on clinical outcomes

## 4. Cerebrospinal Fluid Drainage

Use of CSF drainage to lower ICP in patients with an initial Glasgow Coma Scale (GCS) <6 during the first 12 hours after injury may be considered.

## 5. Ventilation therapies

Prolonged prophylactic hyperventilation with partial pressure of carbon dioxide in arterial blood ( $\text{PaCO}_2$ ) of 25 mm Hg or less is not recommended.

## 6. Anesthetics, Analgesics, and Sedatives

High-dose barbiturate administration is recommended to control elevated ICP refractory to maximum standard medical and surgical treatment. Hemodynamic stability is essential before and during barbiturate therapy.

## 7. Steroids

The use of steroids is not recommended for improving outcome or reducing ICP.

## 8. Nutrition

Feeding patients to attain basal caloric replacement at least by the fifth day and, at most, by the seventh day post-injury is recommended to decrease mortality.

**9. Infection Prophylaxis**

Early tracheostomy is recommended to reduce mechanical ventilation days when the overall benefit is felt to outweigh the complications associated with such a procedure.

**10. Deep Vein Thrombosis Prophylaxis**

Low molecular weight heparin (LMWH) or low-dose unfractionated heparin may be used in combination with mechanical prophylaxis. However, there is an increased risk for expansion of intracranial hemorrhage.

**11. Seizure Prophylaxis**

Phenytoin is recommended to decrease the incidence of early PTS (within 7 days of injury), when the overall benefit is felt to outweigh the complications associated with such treatment. However, early PTS have not been associated with worse outcomes.

# Monitoring and Thresholds

**Tae Kyoo Lim**

Gachon University Gil Medical Center, Korea

In 2016, the Brain Trauma Foundation updated Guidelines for the Management of Severe Traumatic Brain Injury (4<sup>th</sup> edition).

In particular, the chapter on monitoring previously included three topics. (Indications, Technology, and Thresholds) The New Guidelines does not include Indications and Technology. Also, The Intracranial Pressure Thresholds topic was expanded and changed to Thresholds for the new Guideline that includes thresholds for blood pressure, CPP, and ACM, as well as ICP.

Although the use of monitoring is different depending on the income of each country, we will try to help us for treating TBI patients by reviewing the monitoring and thresholds through updated guidelines.



## Oral Session 4: Intervention

**Session Director**

Chang Ho Jeon (Pusan National University, Korea)

**Moderator**

Chang Won Kim (Pusan National University, Korea)

Gil Joon Suh (Seoul National University, Korea)

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- Current Status and Future Direction of Interventional Radiology on Trauma: Focus on Korean Regional Trauma Centers
  - Oral Presentation (OP4)



# **Current Status and Future Direction of Interventional Radiology on Trauma: Focus on Korean Regional Trauma Centers**

**Chang Won Kim**

Pusan National University, Korea

## Angiographic Embolization for Pelvic Fractures in Older Patients

Hohyoung Lee, Min koo Lee, Kyoung Hwan Kim, Sung Ho Han, Soon-Ho Chon, Joongsuck Kim, Oh Sang Kwon

Cheju Halla General Hospital

### Objective

Pelvic fractures can lead to life-threatening hemorrhage, which are a common cause of morbidity and mortality in trauma. The aim of this study is to confirm that older patients have a higher likelihood than younger patients to have bleeding identified and to undergo arterial embolization.

### Methods

Trauma data between January 2016 and October 2017 from a regional trauma center registry were collected and retrospectively reviewed. We compared arterial embolization frequency between the older patients and younger patients.

### Results

The older patients had a higher likelihood than younger patients to have bleeding identified and to undergo arterial embolization (16 of 17 patients vs 39 of 75 patients;  $P < 0.001$ ). An age of 60 years or older was the only independent predictor of the need for Arterial embolization.

### Conclusion

Among blunt trauma patients with significant pelvic fractures, those 60 years and older have a high likelihood of active retroperitoneal bleeding. angiographic embolization should be offered liberally to patients in this age group, regardless of presumed hemodynamic stability.

## Efficacy and Safety of Distal and Proximal Splenic Artery Embolization in Traumatic Splenic Injury: Preliminary Results

Sang Yub Lee, Kyoung Hoon Lim

Kyungpook National University Hospital

### Objective

Traumatic splenic injury is the most common finding in blunt abdominal trauma or penetration injury. To assess the efficacy and safety of the distal and proximal splenic artery embolization for the traumatic splenic injury patients.

### Methods

From March 2017 to January 2018, twenty patients were treated with splenic artery embolization for traumatic injury. Among them, seven patients were treated with distal and proximal splenic artery embolization for traumatic splenic injury. Indication of proximal splenic artery embolization was remained bleeding or contrast blushing after distal selective splenic artery embolization. We analyzed the technical and clinical success of the embolization. And infarcted spleen volume was calculated using the computed tomography data. Delayed bleeding or embolization related complication was also analyzed.

### Results

All seven patients were successfully treated and the mean age was 44 years (range 7-59, four male). The mean injury severity score was  $17.7 \pm 6.1$ . Technical and clinical success rates were 100%. Coils and glue were used as embolic materials. The mean follow-up was taken in 104 days (range 31-226 days). The mean infarcted splenic volume percentage was  $47 \pm 32\%$ . There was no delayed splenic rupture or bleeding, embolization related infection, or splenic abscess.

### Conclusion

In our preliminary results, embolization of the proximal splenic artery following the distal selective embolization in traumatic high grade splenic injury is safe and effective treatment strategy for acute hemodynamically unstable patients. More large-scale prospective study is required to confirm our strategy.

## **Role of Interventional Radiology in Trauma Care: Retrospective Study from Single Trauma Center Experience**

Hyounghook Kim, Nam Yeol Yim, Yang Jun Kang, Byung Chan Lee, Jae Kyu Kim

Chonnam National University Hospital

### **Objective**

Although interventional management is now regarded as essential in trauma care, the effect on clinical result remains uncertain. We conducted this retrospective study to figure out the role of interventional management in trauma care.

### **Methods**

Medical records of patients enrolled in the trauma database of our trauma center were reviewed for the period of January 2009 to December 2012. During this period, we have evaluated how many interventional procedures were conducted and the clinical effect of interventional procedure on trauma care.

### **Results**

Based on our institutional trauma database, medical records of 2017 patients were reviewed (male/female, 1475:542; mean age, 50.03 years). Their mean injury severity score was approximately 26.28. Among them, 111 patients have been treated with interventional procedure. The number of interventional procedures increased significantly over time, up to 15% ( $P<.005$ ). During the same period, the overall survival rate did not show significant change. The survival rate of the patients, who have been treated with interventional procedures for traumatic vascular injury, was higher than possibility of survival from trauma injury severity score (86.4% vs 65.59%).

### **Conclusion**

The need for interventional procedure in trauma care is increasing. Although interventional procedure could not affect the overall survival rate in trauma care, it can improve survival rate remarkably in patients with traumatic vascular injury.

## Transcatheter Arterial Embolization for Management of Traumatic Bleeding: Single-Center Experience

Bong Man Kim, Min Jung Choi

Dankook University Hospital

### Objective

The objective of this study is to analyse the technical success of transcatheter embolization (TAE) for traumatic bleeding in our institution

### Methods

From January 2013 to November, 169 patients were referred to our interventional unit for the TAE of bleeding following trauma. Clinical data, contrast-enhanced CT images, and angiographic findings were reviewed. The technical success and peri-procedural hemodynamic status were evaluated as body parts.

### Results

In 169 trauma patients 195 TAE were performed. The embolized body parts were thorax (n=8), liver (n=31), spleen (n=36), kidney (n=19), pelvis (n=75), lumbar (n=9), hollow viscus (n=5), and others (n=12). 171/195 patients were achieved hemodynamic stable after TAE, and overall clinical success was about 87.6%. The clinical success as body parts were thorax (7/8, 87.5%), liver (28/31, 90.3%), spleen (35/36, 97.2%), kidney (18/19, 94.7%), pelvis (61/75, 81.3%), lumbar (n=6/9, 66.6%), hollow viscus (5/5, 100%), and others (11/12, 91.6%).

### Conclusion

TAE is a effective and reliable treatment option to control traumatic bleeding as a minimally invasive alternative to surgery.

## Transcatheter Arterial Embolization for Traumatic Thoracic Bleeding: 4-years Experiences in a Single 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 Kim<sup>1</sup>, Chan Yong Park<sup>2</sup>

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

### Objective

We aimed to assess the safety and efficacy of transcatheter arterial embolization (TAE) for thoracic arterial hemorrhage following chest trauma.

### Methods

From November 2013 to May 2017, 35 patients were referred to our interventional unit for thoracic arterial bleeding following chest trauma, based on clinical decisions and computed tomography (CT) images. A total of 35 patients (male:female ratio, 26:9; mean age, 52.9 years) who underwent selective TAE of thoracic hemorrhage-culprit arteries were included in this study. Technical and clinical success, complications, and 30-day mortality rate were analyzed.

### Results

In 35 patients who underwent TAE, the main bleeding arteries were in the intercostal artery (n=23), internal mammary artery (n=11) superior and/or lateral thoracic artery (n=3), and bronchial artery (n=3). N-butyl-2-cyanoacrylate (NBCA) (n=21), gelatin sponge particles (n=7), microcoils (n=2), and combinations of NBCA, microcoils, or gelatin sponge particles (n=10) were used as embolic agents. Initial technical success was achieved in all 27 patients, with immediate cessation of bleeding. Eight patients showed rebleeding 1-2 days later and underwent repeated TAE with successful result. Clinical success rate was 85.7% (30/35), and five patients underwent thoracotomy for controlling residual bleed. There were no TAE-related major complications infarction or quadriplegia. The 30-day mortality rate was 5.7% (2/35).

### Conclusion

Our clinical experience suggests that TAE used to control thoracic arterial bleeding following chest trauma is safe and effective as a minimally invasive alternative to surgery.

## Nurses in Trauma Field

**Session Director**

Byungchul Yu (Gachon University, Korea)

**Moderator**

Byong Ok Lee (The Catholic University Uijeongbu St. Mary's Hospital, Korea)

Eui Suk Jeong (Armed Forces Capital Hospital, Korea)

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- Is It Special? Nurses in the Trauma Field
- Trauma Quality Improvement
- Trauma Resuscitation and Intensive Care Unit Nursing
- Trauma Surgery



# Is It Special? Nurses in the Trauma Field

**Byungchul Yu**

Gachon University, Korea

Trauma care systems and trauma centers offer unique and variable opportunities for nurses. And the care of critically ill trauma patient is very complex and requires the expertise and skills. In this presentation, I will explain trauma nursing as a specialty and discuss the role and functions of the trauma nurse coordinator, physician assistant and nurses who dedicated to trauma ICU and trauma bay, briefly.

# Trauma Quality Improvement

Suji Kim

Pusan National University Hospital, Korea

The quality improvement of the trauma center were introduced to improve the quality of medical care through evaluation of medical services and medical systems provided to trauma patients. I'm going to lecture on my quality improvement activities as trauma PI coordinator.

Content of the Lecture

- a) Introduction
- b) Necessity of quality improvement in Trauma centers
- c) Quality management system in PNUH Trauma center
- d) Techniques of trauma quality improvement in PNUH Trauma center: case oriented

Through this lecture I hope to share the ways of improving the quality of each trauma center.

# Trauma Resuscitation and Intensive Care Unit Nursing

**Kyung Mi Kim**

Dankook University, Korea

Trauma resuscitation in the ICU is an engaging and sometimes exhausting activity. Its principles are simple, and can be applied in many non-traumatic patients in the surgical or cardiac surgery ICUs, as well as the occasional medical patient with massive GI or similar bleeding. Just remember:

Replace the blood

1. Use primarily blood products
2. Transfuse them in a balanced ratio
3. Warm them up and give them fast
4. Use a massive transfusion protocol
5. Transfuse enough, but no more
6. Consider autotransfusion

Stop the bleeding

1. Maintain normothermia
2. Replete calcium
3. Prevent acidosis
4. Address specific deficiencies in clotting

And keep your eyes peeled for anything else

1. Send regular labs
2. Attend to the airway and breathing
3. Keep an eye on the heart
4. Do not miss a surgical or correctable condition

# Trauma Surgery

**Myung Jin Jang**

Gachon University Gil Hospital, Korea

## Oral Session 5: Resuscitation

**Session Director**

Sun Hee Kim (Pusan National University, Korea)

**Moderator**

Young Rock Ha (Bundang Jesaeng General Hospital, Korea)

Seog-Ki Lee (Chosun University, Korea)

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- Recent Updates of Damage Control Resuscitation
- Perioperative Intravascular Volume Resuscitation in Trauma Patient: Anesthesiologist's Perspective
- Oral Presentation (OP5)



# Recent Updates of Damage Control Resuscitation

**Jae Hun Kim**

Pusan National University, Korea

The concept of damage control resuscitation has started from damage control surgery. Currently, damage control resuscitation is used as a big concept including damage control surgery. Damage control resuscitation is a systematic approach to the management of severely injured patients that starts in the emergency room and continues through the operating room and the intensive care unit (ICU).

Damage control resuscitation aims to maintain appropriate circulating volume, control haemorrhage and correct the 'lethal triad' of coagulopathy, acidosis and hypothermia until definitive intervention is completed. Twenty years ago, the resuscitation strategy of severely injured patients focused on the rapid reversal of acidosis and prevention of hypothermia through damage control surgery. However, direct treatment of coagulopathy was not emphasized in damage control resuscitation. Recently, better understanding of the pathophysiology of coagulopathy in trauma patients has led to many studies about damage control resuscitation that directly address this coagulopathy.

Damage control resuscitation consists of haemostatic resuscitation, permissive hypotension, prevention of hypothermia, and damage control surgery. The administration of blood products consisting of fresh frozen plasma, packed red blood cells, and platelets, the ratio of which resembles whole blood, is recommended early in the resuscitation. Hypotension is allowed until definitive hemostatic measures begin. In addition, recent studies have suggested the administration of tranexamic acid.

Now, damage control resuscitation is the most beneficial measure available to treat trauma-induced coagulopathy. It allows the trauma surgeon to correct the coagulopathy of trauma as a structural intervention with damage control surgery. Here I will review recent updates of damage control resuscitation.

# Perioperative Intravascular Volume Resuscitation in Trauma Patient: Anesthesiologist's Perspective

Tae-Yop Kim

Department of Anesthesiology, Konkuk University Medical Center, Korea

In this lecture, five major learning objectives will be mentioned and described, as follows.

- Pathophysiology of coagulopathy and hemodilution in trauma patients.
- Basic concept for maintaining normovolemia and preventing iatrogenic hemodilution and transfusion.
- Condition aggravating/exacerbating trauma-induced coagulopathy
- Preference of balanced crystalloid solution, rather than hypertonic NaCl solution (abNormal saline)
- Goal-directed transfusion rather than conventional protocol-based transfusion

## Resuscitative Endovascular Balloon Occlusion of the Aorta: A Single Trauma Center Experience in Korea

Dong Hun Kim<sup>1</sup>, Sung Wook Chang<sup>2</sup>, Seok Won Lee<sup>1</sup>, Ye Rim Chang<sup>1</sup>, Jeongseok Yun<sup>1</sup>, Seokho Choi<sup>1</sup>, Jung-Ho Yun<sup>3</sup>

Departments of <sup>1</sup>Traumatic Surgery, <sup>2</sup>Thoracic and Cardiovascular Surgery, <sup>3</sup>Neurosurgery, Trauma Center, Dankook University Hospital

### 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 exsanguinating abdominal or pelvic injuries after multiple blunt trauma in Korea.

### Methods

REBOA performed at a level I trauma center from August 2016 in which an institutional REBOA protocol was established. The level of aortic occlusion for REBOA was indicated as the aortic zone reported previously. Zone I consists of the thoracic aorta below left subclavian artery and zone III includes the infrarenal aorta. Balloon catheters were used with 7 or 12Fr.

### Results

REBOA was performed in 19 patients, median age was 52 years (range, 7-89 years), and 68.4% were male. All patient sustained blunt trauma, and the median injury severity score was 32 (range, 16-75). Of them, aorta was occluded in zone I of 10 patients (52.6%) with abdominal organ injuries and zone III of 5 (26.3%) with unstable pelvic fracture, and the procedure was failed in 2 patients (10.5%). Thoracic injury and upper cervical spine injury identified respectively in the 2 zone I patients attributed to refractory shock. Three patients died with cardiopulmonary resuscitation in progress at the time of REBOA. Four patients (21%) survived with damage control procedure following REBOA (3 zone I, 1 zone III). In the successful REBOA, median door-to-puncture time was 23.5 minutes (range, 10-120), and median balloon duration was 48.5 minutes (range, 30-104). REBOA-related complication was presented with skin necrosis on foot dorsum in a zone III patient.

### Conclusion

REBOA targets on achieving temporary aortic occlusion in trauma patients with exsanguinating abdominopelvic hemorrhage, and so that may be an effective resuscitative modality as a bridging procedure for definite bleeding control.

## **An Analytical Study for Blood Transfusion in Trauma Patients at a Regional Emergency Department**

Dong-Keun Kim, Young-Hoon Yoon, Sung-Hyuk Choi, Jung-Youn Kim, Young-Duck Cho

Korea University Guro Hospital

### **Objective**

Blood transfusion in most trauma patients is transient. So, the practical clinical cases of transfusion are not sufficiently analyzed. By investigating actual blood transfusion process in trauma patients, we compare the difference between the transfusion protocol plan and the actual clinical application.

### **Methods**

We analyzed 64 patients in trauma surgery department who received any transfusion from March 2015 to March 2017, retrospectively. In each case, the patient's characteristics, sex, age, trauma mechanism, ISS score, vital signs and transfusion time were investigated.

### **Results**

The trauma patients who received blood transfusions accounted for 64% of men, the percentage of pedestrian accidents accounted for 28.1%, the most injury part occupied 60.9% of the pelvic bone, and the patients who received surgery within 24 hours from ER visit are accounted for 59.4%. At the time of ER visit, the mean SBP was 95.8 mmHg, HR was 92.6/min, RR was 21.4/min, and BT was 36.3 degrees. The average ISS score of the ER visiting patients was 43.8, the average ABC score was 0.9, the mean transfused RBC count was 5.0, the FFP number was 4.3, and the PLT was 1.3. The average time to transfusion prescription after patient visit is 94.7 minutes. When prescribed within 1 hour, the average time to transfusion order is 16.1 minutes and the time from prescription time to actual transfusion is 157.5 minute on average. There was no significant difference on time from initial transfusion order to actual blood release between in group with transfusion order within 1 hour and over 1 hour.

### **Conclusion**

The time from ER visit to prescription was longer than 1 hour and the time from transfusion prescription to actual transfusion is not significantly different between emergency transfusion and non-emergency transfusion. Therefore, a rapid blood transfusion system is needed to improve this.

## Prediction of Patients with Major Trauma Requiring Massive Blood Transfusion: A Comparison of ABC, TASH, PWH, SI Scores in Korean Trauma Patients

Yang Bin Jeon, Ahram Han, Myung Jin Jang

Gachon University Gil Medical Center

### Objective

The purpose of this single center retrospective study was to validate the accuracy of existing scoring systems of massive transfusion (MT) in Korean trauma patients.

### Methods

Among trauma patients who were admitted to a regional trauma center between January 1, 2014 and December 31, 2016, those who were  $\geq 13$  of age, with injury severity score over 15, and who had received  $\geq 1$  RBC units during initial 24 h were included. Previously developed scores [Assessment of Blood Consumption (ABC), Trauma-Associated Severe Hemorrhage (TASH), Prince of Wales Hospital (PWH), and shock index (SI)] were calculated for each patient according to the published methods. Performance of each scoring system to predict the need of MT was compared using area under the receiver operator curve (AUROC). MT was defined as (1)  $\geq 1$  RBC unit within 2 h and (2)  $\geq 5$  RBC units or death from hemorrhage within 4h.

### Results

Among the 562 patients who met the inclusion criteria, 176 (31.3%) patients were classified as MT patients. According to multivariate logistic regression, initial systolic blood pressure, heart rate, Glasgow coma score, and free abdominal fluid were associated with MT. When receiver operator curve of ABC, TASH, PWH, and SI were plotted, all four scoring systems were good predictors of MT with AUROC of 0.828, 0.844, 0.866 and 0.811, respectively. When previously reported cut-off values were applied, ABC, TASH, PWH scores showed high specificity (93.8%, 96.8%, and 93.4% respectively), but low sensitivities (50.6%, 31.8%, and 49.1% respectively).

### Conclusion

ABC, TASH, PWH, and SI showed comparable capabilities in predicting MT in Korean trauma patients. Previously reported cut-off values of ABC, TASH, and PWH were skewed towards higher specificity leading to low sensitivity and high false negative rate.

## Blood Pressure and Pulse Rate Changed before and after Decompression Surgery: Reverse Cushing Phenomenon

Do-Sung Yoo

St. Paul's Hospital, The Catholic University of Korea, College of Medicine

### Objective

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

### Methods

60 patients who had taken decompressive craniectomy were included in this study. All of these patients were under general anesthesia, so the respiration rate and body temperature were maintained in a steady state. Systemic mean arterial blood pressure and pulse rate were compared before and after the craniectomy with 5 minute intervals. Data analyze 30 minutes before and after the decompressive craniectomy were collected.

### Results

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

### Conclusion

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

## The Appropriateness of Routine Chest Decompression for Traumatic Cardiorespiratory Arrest

KyuHyouck Kyoung, SangChul Lee, Minae Keum, SukJung Yang,  
Sungkyun Park, JiHoon Kim, EunSug Hong, ByungHo Choi, MinSu Kim

Ulsan University Hospital

### Objective

Traumatic cardiorespiratory arrest has a poor outcome. Thoracic trauma is the leading cause of traumatic cardiorespiratory arrest (TCRA). In the situation of TCRA, it is very difficult to make a decision for treatment priority. The purpose of this study was to investigate the practical value of routine chest decompression for early TCRA.

### Methods

We reviewed thoracic trauma among the patients who were dead at emergency department (ED) between January 2014 and December 2017. The patients who were transferred from another hospital were excluded.

### Results

A total of 73 patients were enrolled. Thoracic trauma occurred in 66 (90.4%) patients and hemo or pneumothorax was confirmed in 62 (84.9%) patients. Mean chest abbreviated injury scale (AIS) was  $4.1 \pm 0.9$  and 46 (63.0%) patients showed AIS equal or more than 4.

### Conclusion

In the situation of early TCRA or impending arrest, chest decompression should be performed immediately to correct the cause of high probability at ED or prehospital setting.

## Initial Experience of REBOA for Severe Trauma in Single Institution: Case Series

Dae Sung Ma

Trauma Center, Gachon University Gil Medical Center

### Objective

REBOA has several advantages to resuscitation for extremis trauma patients over conventional aorta clamping via thoracotomy. Thus, REBOA has accepted essential procedure in extremis trauma patients, especially unstable pelvic fracture with hemorrhagic shock.

This study was to describe the initial experience of REBOA in our Regional Trauma Center.

### Methods

This is a retrospective describe for patients were undergone REBOA in our institution from December 2015 to December 2017. Demographics, and physiologic data, mechanism of injuries, timing of intervention, clinical course after procedure and outcomes were reviewed.

### Results

A total 12 patients who all were in severe trauma undergone REBOA during study period. All of cases were performed on TER. Male were 9 (75%) and female were 3 (25%). The Mean age were 45.55 [range 12-74]. All patients were suffered from blunt trauma, MVC 6 (50%) and fall down 6 (50%).

Time lag from arrive to REBOA was mean  $49.50 \pm 25.39$  (min). SBP before procedure was mean  $56.75 \pm 23.37$  mmHg. And SBP after procedure was mean  $114.40 \pm 18.07$  mmHg.

The mean ISS was 44 [range 26-75], RTS 3.764 [range 0-7.841], TRISS 36.07% [range 0-97.4%].

Among of them, two patients within CPR before REBOA were not respond the REBOA and death in TER. The rate of success resuscitation in TER after REBOA, 83% (10/12) were respond the REBOA. Among of them, 4 patients were death due to uncontrolled bleeding after REBOA in operating room or intervention room and, and 2 patients with severe liver injury (Gr V and VI) were death due to MOF after 4 day. The rate of survival after REBOA in our Center during two years was 33.3% (4/12).

### Conclusion

REBOA for selective patients with extremis in trauma may be the last chance to provide survival opportunity.

## Oral Session 6: Research

**Session Director**

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

**Moderator**

Kun Hwang (Inha University, Korea)

Young Ho Lee (Seoul National University, Korea)

- 
- Cell Study Approach in Hemorrhagic Shock Model
  - Oral Presentation (OP6)



# Cell Study Approach in Hemorrhagic Shock Model

**Sung-Hyuk Choi**

Department of Emergency Medicine, Korea University, Korea

Hemorrhagic shock is important as the cause of most deaths from major trauma. Trauma is not only a decline in the people's quality of life, but also a great loss to the socio-economic sector. As a result, the establishment of trauma centers has contributed a great deal to reducing the death rate of patients with severe injuries.

In many developed countries, however, although rapid and appropriate trauma patients have been dealt with, trauma constitutes a large part of death and causes losses to the nation by causing a loss of economic ability in the younger age group.

Therefore, we want to know the changes in cells from shock states due to a lack of oxygen and nutrients to the cells and also want to identify the mechanism of damage to sepsis, multiple organ failure caused by an imbalance of body homeostasis due to hyperinflammation and immunosuppression, despite appropriate trauma management. Therefore, we would like to discuss the factors that could predict sepsis, multiple organ failure and the effects on medications.

## Serial Measurement of Immune Cells in Severe Trauma Patients

Do Wan Kim, In Seok Jeong

Chonnam National University Hospital

### Objective

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

### Methods

From January to December 2017, we studied 21 patients who were admitted to Chonnam National University Hospital, Regional Trauma Center with chest trauma.

Blood sample tests were performed on the day of admission, day1, day3, day7, and day30 of admission. Granulocyte (CD66b), helper T-cell (CD4), cytotoxic T cell (CD8), Gamma delta T cell (CD3+TCR $\gamma\delta$ ), regulatory T cell (CD25+Foxp3+), B-cell (CD19), NK cell subtypes (CD56brightCD16 $\pm$ , CD56dimCD16+, CD56-CD16+), Monocyte subtypes (CD14+CD16-, CD14CD16+, CD14+CD16+) level were measured in the peripheral blood by flow cytometry.

### Results

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

### Conclusion

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

## A Hands-on Course on Endovascular Training for Resuscitative Endovascular Balloon Occlusion of the Aorta (ET-REBOA)

Sung Wook Chang, Seok Won Lee, Han Cheol Jo, Dong Hun Kim, Ye Rim Chang

Dankook University Hospital

### Objective

Resuscitative endovascular balloon occlusion of the aorta (REBOA) has emerged as a salvage technique changing the paradigm in the management of non-compressible torso hemorrhage. However, training for the REBOA procedure is rarely performed. The endovascular training for REBOA (ET-REBOA) course was provided to develop the endovascular skills of participants.

### Methods

Sixteen residents and 12 specialists in Dankook University Hospital participated in this educational course. The ET-REBOA course consisted of 2 sections: the first was an ultrasound-guided sheath insertion on the puncture model, and the second was a balloon inflation in zones I and III on the vascular circuit model. All participants were provided with pre-course learning materials that consisted of a lecture on the introduction of REBOA and a demonstration video clip a week before the course. On the day of training, 30 minutes of lecture using the video clip was provided. A 12-item checklist and the time required to perform the procedure were examined.

### Results

Twenty-eight participants performed the 56 REBOA procedures. On the first attempt, the median total time for REBOA from ultrasound-guided vascular access to balloon inflation was  $828 \pm 280$  seconds (range, 478-1384) in the specialist group and  $1139 \pm 250$  seconds (range, 513-1329) in the resident group. On the second attempt, the median time required was  $584 \pm 103$  seconds (range, 375-777) in the specialist group and  $719 \pm 250$  seconds (range, 460-1483) in the resident group. The mean shortened time on the second attempt for each participant was 290 and 273 seconds in the specialist and resident groups, respectively.

### Conclusion

The ET-REBOA course offered improvements on the participants' endovascular skills for resuscitation and hemorrhage control. Thus, this could be an effective curriculum for the development of endovascular skills for performing REBOA.

## Predictive Values of Magnetic Resonance Imaging Features for Tracheostomy in Traumatic Cervical Spinal Cord Injury

Tae Seok Jeong, Sang Gu Lee, Woo Kyung Kim, Yong Ahn, Seong Son

Gachon University Gil Medical Center

### Objective

To evaluate the magnetic resonance (MR) imaging features that have a statistically significant association with the need for a tracheostomy in patients with cervical spinal cord injury (SCI) during the acute stage of injury.

### Methods

This study retrospectively reviewed the clinical data of 130 patients with cervical SCI. We analyzed the factors believed to increase the risk of requiring a tracheostomy, including the severity of SCI, the level of injury as determined by radiological assessment, three quantitative MR imaging parameters, and eleven qualitative MR imaging parameters.

### Results

Significant differences between the non-tracheostomy and tracheostomy groups were determined by the following five factors on multivariate analysis: complete SCI ( $p=0.007$ ), the radiological level of C5 and above ( $p=0.038$ ), maximum canal compromise (MCC) ( $p=0.010$ ), lesion length ( $p=0.022$ ), and osteophyte formation ( $p=0.015$ ). For the MCC, the cut-off value was 46%, and the risk of requiring a tracheostomy was three times higher at an interval between 50-60% and ten times higher between 60-70%. For lesion length, the cut-off value was 20 mm, and the risk of requiring a tracheostomy was two times higher at an interval between 20-30 mm and fourteen times higher between 40-50 mm.

### Conclusion

The ASIA grade A, a radiological injury level of C5 and above, an MCC  $\geq 50\%$ , a lesion length  $\geq 20$  mm, and osteophyte formation at the level of injury were considered to be predictive values for requiring tracheostomy intervention in patients with cervical SCI.

## Effect of Obesity by Sex on Traumatic Brain Injury in Motor Vehicle Collisions

Sang-Chul Kim<sup>1</sup>, Yeon-il Choo<sup>1</sup>, Hae-Ju Lee<sup>1</sup>, Kang Hyun Lee<sup>2</sup>, Ho Jung Kim<sup>3</sup>

<sup>1</sup>Chungbuk National University Hospital, <sup>2</sup>Yonsei University Wonju College of Medicine Wonju Severance Christian Hospital,

<sup>3</sup>Soonchunhyang University School of Medicine Bucheon Hospital

### Objective

Obesity has become more prevalent worldwide and is one of the world's biggest health problems. We sought to assess if obese passengers are associated with decreased head injury by sex in motor vehicle collisions (MVCs)

### Methods

This is a retrospective observational cohort study. The crash data were obtained from the International Center for Automotive Medicine (ICAM) for calendar years 2000-2014. Occupants older than 16 years resulting from MVCs were eligible, excluding cases with unknown values (BMI, seat belt, car type, and position). Body mass index (BMI) was classified into normal (BMI < 25), preobese (25 ≤ BMI < 30), obese (30 ≤ BMI). Primary endpoints was serious head injury (AIS scores of ≥ 3). We performed multivariate logistic regression models using all possible configurations of vehicle, demographic, and injury variables and calculated adjusted odds ratios (AORs) of BMI for study outcomes adjusted for any potential confounders (age, delta V, position, restraint, car type, and crash direction).

### Results

Among enrolled 588 patients, 262 were male with 30.9% normal, 40.1% preobese, and 29.0% obese subgroup, and 326 were female with 44.8% normal, 24.8% preobese, and 30.4% obese subgroup. In model 1 that adjusting age, AORs (95% CI) of severe head injury in male group were 0.475 (0.255-0.884) in preobese subgroup and 0.441 (0.225-0.864) in obese subgroup. In model 2 adjusting potential confounders, preobese and obese subgroups of male also have a preventive effect of severe head injury (AOR (95% CI): 0.492 (0.259-0.937), 0.489 (0.243-0.986), respectively). In female group, OR reduction was shown only in obese subgroup (AOR (95% CI) in model 1: 0.537 (0.291-0.993)).

### Conclusion

Male obese passenger has decreased head injury in MVCs, however, female obese passenger has a partial effect on preventing head injury in MVCs. Further analysis is necessary to verify the correlation between obesity and head injury by sex in terms of morphomics.

## The Validity of the Korean Triage and Acuity Scale in Trauma Patients with Low Consciousness

Sil Sung, Kang Hyun Lee, Oh Hyun Kim, Woo Jin Jung, Hyun Youk,  
Hee Young Lee, Joon Seok Kong, Chan Young Kang

Wonju College of Medicine, Yonsei University

### Objective

The purpose of this study was to evaluate the adequacy of KTAS in the classification of traumatic patients who have had unconsciousness in the emergency room.

### Methods

This retrospective study from June, 2016 to May, 2017, the patients who suffered from low consciousness among the trauma patients visited the emergency room. The mental state was defined as patients with unconsciousness less than Verbal based on AVPU. A total of 433 patients were analyzed except for those with unclear consciousness or inadequate judgment. The general characteristics, hospitalization rate, mortality, and length of stay were compared for each stage of KTAS.

### Results

The subjects were 433 with an average age of  $54.9 \pm 19.2$  years. At the level of consciousness on arrival Verbal 205 (47.5%), Pain 114 (26.3%) and Unresponsive 114 (26.3%). Levels of KTAS were level 1 218 (50.3%), level 2 186 (43.0%), level 3 22 (5.1%), level 4 7 (1.6%) and level 5 0 (0%). The GCS scores were  $5.15 \pm 3.09$  in level 1,  $11.77 \pm 2.35$  in level 2,  $13.05 \pm 1.09$  in level 3 and  $13.00 \pm 1.91$  in level 4. The hospitalization for each level was 96.9% for level 1, 95.2% for level 2, 59.1% for level 3, and 40% for level 4. The level of admission to the ICU was 91.6% and level 2 was 73.4%. The deaths occurred only at level 1 and 2, and mortality rates were 22.9% and 5.4%, respectively. The total hospitalization period was from level 1 to 23.58 days, 26.45 days, 18.00 days, and 0.43 days. The lower the severity, the shorter the length of stay.

### Conclusion

In the patients with low consciousness, KTAS showed a difference between level 1 and level 5 when the hospitalization rate, mortality rate, and hospitalization period were analyzed. Therefore, the KTAS classification is valid.

## Comparison of the Various Surgical Approaches for Traumatic Frontal ICH

Ki Seong Eom, Seong Keun Moon

Wonkwang University Hospital

### Objective

Although there is no consensus regarding various surgical approaches for frontal Traumatic intracerebral hemorrhage (TICH), we believe that the frontal craniotomy through bicoronal incision is most likely to be used. In this study, we compared the treatment efficacy and results of different surgical approaches for decompressive conventional craniectomy and craniotomy, supraorbital key-hole approach, and navigation-guided burr hole drainage for frontal TICH and attempted to find out the best surgical treatment for frontal TICH.

### Methods

From February 2011 to May 2017, 54 patients underwent operation for frontal TICH in our institute. Of those patients, 13 patients underwent decompressive craniectomy, 25 patients underwent frontal craniotomy, 5 patients underwent supraorbital key-hole approach, and 11 patients underwent navigation-guided burr hole drainage. We compared variables between the groups to investigate clinical variables that are related to surgical outcome and radiological findings. We also discussed indications, advantages, and disadvantages for each surgical approach.

### Results

With developing the microscope-assisted surgical techniques, we have done the evacuation of hematoma through supraorbital key-hole approach. These techniques have several benefits including a shorter operative time, less tissue damage and blood loss, and faster postoperative recovery. Navigation-guided burr hole drainage could use under local anesthesia and useful in the elderly patients as well as patients with poor health. However, postoperative computed tomography showed relatively unsatisfactory evacuation of hemorrhage.

### Conclusion

We believe that the supraorbital key-hole approach is useful for the evacuation of hematoma, thereby resulting in a favorable outcome, especially TICH with slight brain contusion. Further research is warranted for determination of the most appropriate surgical method for this lesion.



## Mini Oral Presentation 1 (MINI-OP1)

**Moderator**

Kun Hwang (Inha University, Korea)

Ji Hoon Kim (University of Ulsan, Korea)

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## Tracing the Use of Cautery in the Modern Surgery

Kun Hwang

Inha University Hospital

### Objective

To trace the use of cautery in the modern surgery.

### Methods

Literature reviews were performed.

### Results

Celsus (BC 42-AD 37) first described the ligation of arteries for wounds. From Galen, who wrote the ligation of arteries for aneurysms, to the fifteenth century, little progress was made, but then gunpowder was developed, and the number and severity of battle wounds increased. Abulcasis (936-1013), invented hot rod heating device to use clinically on smack bleeders and the patients survived. He wrote a book on doing surgical procedures with minimizing the bleeding, however, the problems were contamination and wound infection. Vigo (1450-1525), an Italian surgeon recommended treating firearm wounds with boiling oil. After Vigo, thermal cauterization was applied to areas of bleeding. Wounds of firearm victims were seared with a hot metallic object. Silk was used in China for centuries before Christian era. The Chinese used silk suture before Ambroise Paré (1510-1590). This french surgeon, reintroduced the ligature of arteries, which had been introduced by Celsus and Galen, used in China, instead of cauterization during amputation. During Paré's era, the usual method of sealing wounds by searing them with a red-hot iron often failed to arrest the bleeding, which caused patients to die of shock. He described the technique of using ligatures to prevent hemorrhaging during amputation (1564). William Bovie (1882-1958), an American physicist, invented an electrosurgical device. Harvey Cushing (1895-1935), an American neurosurgeon, employed Bovie's electrocautery tool in neurosurgical cases (1926). Bovie produced an electric arc that generate heat to help Cushing removing meningioma without death of the patient from small vessel bleeding that could not get ligated using the Chinese silk sutures. Cushing played a pivotal role in development of electrocoagulation.

### Conclusion

To modern day, electrosurgical unites which produce a heated arc that stop the bleeding is widely used.

## The Analysis of Traumatic Abdominal Wall Hernia According to the Energy Level of Trauma

Jihoon Jang, Chaeyoon Lee, Jinyoung Park, Kyoung Hoon Lim

Kyungpook National University Hospital

### Objective

Acute traumatic abdominal wall hernia is extremely rare. The literature at present consists of only a few small-scale reported series and a number of case reports. We analyzed patients' medical records and images in order to find out the difference of hernia pattern and injury severity according to the mechanism and energy level of trauma.

### Methods

This study is a retrospective review of 17 patients that presented with traumatic abdominal wall hernia from January 2007 to January 2018 at Kyungpook National University Hospital. We analyzed their trauma mechanism, location of abdominal wall hernia (anterior; posterior), energy level of trauma (high; low-energy), presence of intraabdominal organ injury, coincidence of external impact and hernia location, associated injury, operation type (open or laparoscopic; mesh), complications and mortality rates.

### Results

There were 18 cases of abdominal wall hernia among the 17 patients. Of these, 15 cases underwent surgical repair. Mean age was  $57.8 \pm 18.2$  years, and the majority of the patients were male (12/17). Mean ISS was  $19.2 \pm 11.5$  (4-41). We divided the patients into two groups (High-energy injury 10 patients, low-energy injury 7 patients) according to energy level of trauma. In the high-energy group, intraabdominal injury (80% vs. 28.6%), bowel perforation (50% vs. 0%) and posterior hernia (50% vs. 14.3%) were more frequent and The ISS ( $25.6 \pm 9.9$  vs.  $9.9 \pm 6.2$ ) was significantly higher. The coincidence of external impact and hernia location (40% vs. 100%), injury of peritoneum (50% vs. 85.7%) and the possibility of laparoscopic repair (10% vs. 57.1%) were high in the low-energy group. All mortality cases (2cases) were in high-energy injury group.

### Conclusion

High-energy injury was associated with higher severity and more intraabdominal injuries. Therefore, laparoscopic repair was more possible in low-energy injury. Understanding these characteristics will help determine the timing and type of treatment for traumatic abdominal wall hernia.

## The Relationship between CDC Field Triage and Injury Severity Score

Kang Kook Choi

Gachon University Gil Medical Center

### Objective

Korean trauma system has been organized recently. Prehospital transfer system is a one of the important components of trauma system. Korea is using the CDC field triage as a guideline for the trauma field triage. However there is no study about the relationship between the CDC field triage and ISS in Korea.

### Methods

We performed retrospective cohort study.

### Results

1524 patients were enrolled in this study from 2015.01.01-2015.06.30. Of these patients, 234 patients were  $15 < \text{ISS}$ . 42% of the patients who satisfies CDC field triage were  $15 > \text{ISS}$ .

### Conclusion

The development of new field triage according to Korean-trauma characteristics is needed.

## Characteristics of Adolescents Who Present Dominantly with Traumatic Events among Adolescent Patients Who Frequently Visit the Emergency Department

Hyeji Lee, Sun Hyu Kim, Eun Seog Hong, Jung Seok Hong, Ryeok Ahn, Wook-jin Choi

Ulsan University Hospital, University of Ulsan College of Medicine

### Objective

This study was conducted to compare the characteristics of patients with dominantly traumatic events and those with non-traumatic events among total adolescent patients who frequently visit the emergency department (ED).

### Methods

Subjects were the adolescents aged 13-19 years who visited the ED of an academic university hospital from 2010 to 2016. Adolescent patients who visited the ED at least more than four times a year were defined as frequent ED visitors. Among the frequent ED visitors, patients with more than half 50% of total ED visits for traumatic events were classified as Trauma dominant group, and the others as Non-trauma dominant group. This study included both data representing the individual characteristics of each patient and the data describing the events for each ED visit.

### Results

A total of 137 adolescent patients visited the ED 893 times for study period. The non-trauma dominant group comprised 104 patients and the trauma dominant group comprised 33 patients. In non-trauma dominant group, half of patients were male (51%), but all patient of trauma dominant group were male. 66 patients (64%) had medical history in non-trauma dominant group and 5 patients (15%) in trauma dominant group. Accidental trauma was the most common in both groups. The most frequent mechanism of trauma was motorcycle accident (48%) in trauma dominant group and blunt trauma (80%) in non-trauma dominant group. As results of ED treatment, most of patients (85%) of trauma dominant group were discharged from ED. However, 69% of patients were discharged and 23% of patients were admitted in non-trauma dominant group.

### Conclusion

Adolescents who frequently visited the ED with dominantly traumatic events were all male and the most common trauma mechanism was motorcycle traffic accident. Patients of the trauma dominant group had less medical history and better ED result, compared to the non-trauma dominant group.

## Clinical Analysis of the Patients with Isolated Low-velocity Penetrating Neck Injury

Junepill Seok, Hyun Min Cho

Pusan National University Hospital

### Purpose

Although there has been substantial progress for the treatment of thoracic trauma, the mortality of the penetrating neck injury is still high, has been reported about 10-15%. However, there has not been a report which is reflecting Korean medical present. We retrospectively analyzed the penetrating neck injury patients based on the Korean Trauma Data Base (KTDB)

### Methods

Between December 2013 and June 2017 at the trauma center of the Pusan National University Hospital, Pusan, Korea, total of 36 patients with isolated low-velocity penetrating neck injuries were included. We analyzed the patients' age, gender, injury mechanism and causes by medical chart review.

### Results

Among total of 36 patients, 26 (72.2%) were male and 10 (27.8%) were female. Homicidal neck injuries were most common, followed by accidental and suicidal injuries (47% vs. 33% vs. 19%, respectively). All penetrating injuries in our study were low-velocity trauma such as following: knife (n=16, 44.4%); glass or glass bottle (n=11, 30.6%); scissors (n=4, 11.1%); grinder (n=2, 5.6%); and 3 (8.3%) of miscellaneous injuries. 27 (75.0%) patients underwent emergency surgery, and only 1 (2.8%) patient underwent elective surgery. 11 (30.6%) patients were diagnosed with superficial injuries, including 6 patients who had conservative treatment. 12 (33.3%) patients had arterial injuries and 10 (27.8%) patients had venous injuries. The patients who had deep injuries showed significant difference against the patient with superficial injury (98.0 vs. 129.1,  $p=0.008$ ).

### Conclusions

Low velocity penetrating injury confined to the neck is able to be successfully treated with prompt surgical management. Regardless of the conditions which are evaluated at ED, all penetrating neck injury patients should be regarded as urgent surgical candidates.

## Good Bye to Romance: Trauma Surgery in the Korean Trauma Center

Byungchul Yu, Jungnam Lee

Gachon University Gil Medical Center

### Objective

The purpose of this study is to evaluate the volumes and types of operative procedures in the single trauma center for three consecutive years.

### Methods

The purpose of this study is to evaluate the volumes and types of operative procedures in the single trauma center for three consecutive years.

### Results

Patients over injury severity scale (ISS) 15 were 1,502 (15.8%) and among them 426 (28.4%) patients were undertaken the operation or interventional radiology (IVR) procedure. The number of the procedures is as follows; 186 for the craniotomy, 79 for the laparotomy and 73 for the IVR.

### Conclusion

The volume of the operation for dedicated trauma surgeon is decreasing rapidly with the evolution of the nonoperative management for trauma. The education for the trauma surgeons have to focus on not only surgery but also critical care and acute care surgery.

## **Will Segmental or Displaced Rib Fractures Really Affect Adverse Outcome? A Retrospective Study: 145 Isolated Blunt Chest Trauma Patients with Rib Fractures**

Junepill Seok, Hyun Min Cho

Pusan National University Hospital

### **Objective**

Rib fractures (RFX) and blunt pulmonary contusion (BPC) after chest trauma are common, but previous studies of RFX have been limited by lack of details and confounded by extrathoracic trauma. We performed a retrospective analysis with isolated blunt chest trauma patients, evaluated the roles of injury variables in more detail.

### **Methods**

Total of 145 patients were included. Rib fracture patterns and lung parenchymal injury were evaluated based on the chest computed tomography on admission, such as the number of RFX and segmental RFX (sRFX), the degree of fracture displacement and BPC. Binary outcomes included tracheostomy, pneumonia, prolonged mechanical ventilation (MV) more than 48 hours. Continuous outcomes such as hospital length of stay (LOS), intensive care unit (ICU) LOS and duration of MV during index hospitalization were also included. The associations between injury variables and outcomes were evaluated by univariate and multivariable analyses.

### **Results**

Univariate analyses showed that BPC18 scores, more numbers of RFX, sRFX and  $\geq$ Grade II RFX were significantly higher in the complication group, and that the presences of BPC, BPC18 $>5.5$ , Grade III RFX, sRFX, and  $\geq$ Grade II sRFX had significant odds of respiratory complications. Multivariable analyses revealed that BPC18 score, the presence of Grade III RFX and sRFX, and the number of  $\geq$ Grade II sRFX were associated with one or more respiratory complications. Also, the number of  $\geq$ Grade II RFX was associated with increased hospital LOS ( $p=0.018$ ). BPC18 score was associated with increased hospital LOS and ICU LOS, and the number of  $\geq$ Grade II sRFX was associated with increased ICU LOS and MV duration.

### **Conclusion**

BPC18 score, the presences of Grade III RFX and sRFX, and the number of  $\geq$ Grade II RFX and sRFX were associated with at least one or more adverse outcomes. So these variables need to be considered as risk factors in future studies.

## Characteristics of the Accident and Cause of the Death According to Age Groups in Elderly Motor Vehicle Driver Accidents

ChanYoung Kang, KangHyun Lee, OhHyun Kim, WooJing Jung, Youk Hyun, HeeYoung Lee, Junseok Kong, Sil Sung

Wonju College of Medicine, Yonsei University

### Objective

The purpose of this study is to determine the characteristics of the accident and the factors affecting the death according to the ages in the elderly driver accident.

### Methods

This study is a retrospective study using the data of the "In-depth investigation of the patients in the emergency department" of Korea Centers for Disease Control and Prevention. From January 2011 to December 2016, we analyzed 40,595 cases of vehicle drivers out of 262,361 traffic accidents. According to the age of the participants, 18 to 54 years old were classified as non - elderly, and those over 55 years old were classified as elderly. In addition, the elderly were classified into three groups according to age. "Young-old" from 55 to 64 years old, "Middle-old" from 65 to 74 years old, and "Old-old" older than 75 years.

### Results

When we compare the "Young-old," "Middle-old," and "Old-old," the wearing rate of the seatbelt decreased to 85.3%, 83.1% and 79.5%. As the ages increased, the percentage of neck injuries was as low as 31.2%, 27.8% and 24.4%, and chest injuries increased to 22.4%, 26.5% and 27.8%, respectively. Multiple regression analysis showed that the probability of death of "Old Old" was 3.2 times(OR 3.227, 95%CI 1.387-7.508) higher than that of "Young Old" and heavy vehicle were about 2.2 times(Odds ratio 2.249, 95%CI 1.051-4.812) higher than non-heavy vehicle and chest injury was 2.3 times (Odds ratio 2.314, 95%CI 1.327-4.034) higher than non-chest injury, and wearing the seatbelt was 0.3 times(Odds ratio 0.306, 95%CI 0.181-0.519) lower than non wearing the seatbelt.

### Conclusion

As elderly driver 's age group increases, the rate of seat belt wear decreased and the proportion of single accidents increased. Elderly driver 's deaths were aged 75 years or older, type of vehicle, wearing seat belt, and chest injury.

## Esophageal Rupture due to Diving in Shallow Waters: A Case Report

Sung Ho Han, Soon-Ho Chon, Min Koo Lee, Oh Sang Kwon, Kyoung Hwan Kim, Jung Suk Kim

Cheju Halla Hospital

### Objective

Delayed esophageal rupture due to blunt injury is not new, however, rupture due to suspected barotrauma is very rare. We describe a case of esophageal rupture in a male 24 yr-old patient after diving in shallow waters.

### Methods

The patient was quadriplegic and could not experience the typical chest pain related to rupture and resulting mediastinitis. The rupture was discovered 4 days after emergency decompressive laminectomy and fusion for his cervical spine. The rupture was evidently caused by barotrauma and was discovered four days after admission. He underwent primary closure and pericardial flap as a life-saving procedure.

### Results

The patient is alive, but still quadriplegic.

### Conclusion

Prompt diagnosis is necessary and awareness of the possibility of such an event distal to the site of injury is of utmost importance for survival.

## **Analysis of Mortality and Epidemiology in 2617 Cases of Traumatic Brain Injury: Korean Neuro-Trauma Data Bank System 2010-2014**

Ki Seong Eom<sup>1,2</sup>

<sup>1</sup>Wonkwang University Hospital, <sup>2</sup>Korean Neurotraumatology Society

### **Objective**

The aims of the Korean Neuro-Trauma Data Bank System (KNTDBS) are to evaluate and improve treatment outcomes for brain trauma, prevent trauma, and provide data for research. Our purpose was to examine the mortality rates following traumatic brain injury (TBI) in a retrospective study and to investigate the sociodemographic variables, characteristics, and causes of TBI-related death based on data from the KNTDBS.

### **Methods**

From 2010 to 2014, we analyzed the data of 2617 patients registered in the KNTDBS. The demographic characteristics of patients with TBI were investigated. We divided patients into 2 groups, survivors and nonsurvivors, and compared variables between the groups to investigate variables that are related to death after TBI. We also analyzed variables related to the interval between TBI and death, mortality by region, and cause of death in the nonsurvivor group.

### **Results**

The frequency of TBI in men was higher than that in women. With increasing age of the patients, the incidence of TBI also increased. Among 2617 patients, 688 patients (26.2%) underwent surgical treatment and 125 patients (4.7%) died. The age distributions of survivors vs. nonsurvivor groups and mortality rates according the severity of the brain injury, surgical treatment, and initial Glasgow Coma Scale (GCS) scores were statistically significantly different. Among 125 hospitalized nonsurvivors, 70 patients (56%) died within 7 days and direct brain damage was the most common cause of death (80.8%). The time interval from TBI to death differed depending on the diagnosis, surgical or nonsurgical treatment, severity of brain injury, initial GCS score, and cause of death, and this difference was statistically significant.

### **Conclusion**

Using the KNTDBS, we identified epidemiology, mortality, and various factors related to nonsurvival. Building on our study, we should make a conscious effort to increase the survival duration and provide rapid and adequate treatment for TBI patients.

**PPTC** 2018

6<sup>th</sup> Pan-Pacific Trauma Congress

## **Mini Oral Presentation 2 (MINI-OP2)**

**Moderator**

Yong-Cheol Yoon (Gachon University, Korea)

Jung-Ho Yun (Dankook University, Korea)

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## Three-Dimensional Analysis of Posterolateral Bare Area Support of Tibial Plateau Fractures: How Does Variable Angle Locking Compression Plate Fixation Compare to Conventional Locking Compression Plate Fixation?

Do-Hyun Yeo, Jong-Keon Oh, Jae-Woo Cho, Ki-Ho Moon, Jin-Kak Kim, Beom-Soo Kim

Korea University Guro Hospital

### Objective

In fixation of a posterolateral tibial plateau fractures (PLF) with the conventional locking compression plate (LCP), the more fracture line extends to posterior, the more difficult to purchase PLF. The variable angle locking compression plate (VA-LCP) was expected beneficial to lateral buttress and support of the posterolateral joint surface. But there was no further study of how much the VA-LCP enhance support of a PLF. This study was to compare articular support area between the LCP and the VA-LCP by three-dimensional (3D) simulation.

### Methods

We scanned two types of plates with screws and applied a 3D imaging by software program. Screws were inserted in two ways. 1) Standard trajectory; perpendicular to plate. 2) Angled trajectory; with 15° posterior angulation. Each plate applied to 3D models of adults' cadavers using a 3D image program. 3D models were made by CT scan from 57 males and 56 females Korean adults' cadavers. 23 cases were excluded because of poor quality of their CT images and lack of their demographic data and the remaining 90 cases were enrolled. The unsupported area and the distance from posterior cortex to screw of both group were measured and compared (SPSS v20).

### Results

The standard trajectory group's unsupported area was 374.27 mm<sup>2</sup> of lateral surface at the screw insertion level. The angled trajectory group's unsupported area was 317.49 mm<sup>2</sup>. The unsupported area was significantly decreased 56.78 mm<sup>2</sup> by VA-LCP ( $p=0.000$ ) and it was 2% decrease. The mean of the posterior screw anteroposterior distance of the standard trajectory group was 12.54 mm and the angled trajectory group's was 10.91 mm. It was significantly decreased 1.63 mm by VA-LCP ( $p=0.000$ ).

### Conclusion

The VA-LCP shows more articular support of a PLF significantly than conventional LCP. But it is not expected to be enough to cover more posterior part where fracture often occurs.

## Results of Fragment Specific Fixation Technique for Posterior Wall Fracture of the Acetabulum

Beom-Soo Kim, Do-Hyun Yeo, Ki-Ho Moon, Jin-kak Kim, Jae-Woo Cho, Jong-Keon Oh

Korea University Guro Hospital

### Objective

The purpose of this study was to determine the clinical outcome in patients whom a displaced fracture of posterior wall of the acetabulum had been treated by Fragment Specific Fixation technique using 2.7 mm VA-LCP.

### Methods

This was a retrospective review of a prospectively collected data at an urban university medical center. Senior surgeon in trauma team used single fragment specific fixation technique managing displaced posterior wall fracture of acetabulum from January 2014 to January 2016. Each posterior wall fracture fragment was buttressed with only single or multiple 2.7 mm VA- LCP according to the fragment size and location. Postoperatively articular reduction and violation of joint was evaluated with plain radiographs and CT scan. The patient was followed at regular intervals for a minimum of 12 months.

### Results

Total 18 patients were followed for an average of 20 months (range, 12-27 months). Average patient age was 45.8 years (range, 18-69 years), and 16 male and 2 female. Articular surface was restore anatomically (gap remaining 0-1 mm) in 14 cases, good (2-3 mm) in 4 cases. The primary union rate was 94% (17/18 pts). Mean time to union was 5.2 months. Complication included one deep infection in patient who had diabetes mellitus.

### Conclusion

Fragment specific fixation technique for posterior wall fracture of acetabulum is safe and effective fixation method for posterior wall fracture of acetabulum, even in comminution.

## A Treatment Strategy to Avoid Iatrogenic Pipkin Type III Femoral Head Fracture-dislocations

Tae-Seong Kim, Chang-Wug Oh, Joon-Woo Kim, Kyeong-Hyeon Park

Kyungpook National University Hospital

### Objective

Reduction is urgently required in cases of traumatic hip dislocation to decrease the risk of avascular necrosis of the femoral head. However, successful reduction may not always be feasible for hip dislocations associated with femoral head fractures. This irreducibility may provoke further incidental fractures of the femoral neck with resultant Pipkin type III injuries. The purpose of this study was to describe an appropriate treatment strategy for irreducible femoral head fracture-dislocations.

### Methods

We treated nine patients with irreducible hip dislocations with femoral head fractures (eight Pipkin type II and one type IV) for which reduction failed in the emergency room or operating theater. All of these cases required operative management.

### Results

Five of the nine patients experienced femoral neck fractures after closed reduction were attempted. These five cases underwent joint replacement at the time of injury or after developing avascular necrosis of the femoral head.

Analysis of radiographs and computed tomography (CT) scans revealed that the fractured femoral head was perched on the sharp angle of the posterior wall of the acetabulum in the irreducible hips. After recognizing the irreducibility, the other four cases underwent immediate open reduction without further attempts at closed reduction, which saved the natural hip joint without neck fracture or avascular necrosis.

### Conclusion

Repeated or forceful closed reduction of irreducible femoral head fracture-dislocation injuries may result in iatrogenic femoral neck fractures with Pipkin type III injuries. Before attempting reduction, careful examination of plain radiographs and CT images may be helpful for determining the safest treatment strategy.

## Case-Match Controlled Comparison of Bone Transport over the Nail and Bone Transport over the Plate for the Segmental Bone Defect of Tibia

Il seo<sup>1</sup>, Chang-Wug Oh<sup>1</sup>, Kyeong-Hyun Park<sup>1</sup>, Joon-Woo Kim<sup>1</sup>, Jong-Keon Oh<sup>2</sup>, Tae-Seong Kim<sup>1</sup>, Jeong Heo<sup>1</sup>

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

### Objective

To compare the radiological results and risk of major complications after either bone transport over the nail (BTON) vs bone transport over the plate (BTOP) for the segmental bone defect of tibia.

### Methods

Either BTON or BTOP were performed on 18 patients each with segmental bone defect of tibia after treatment of traumatic osteomyelitis.

Radiological parameters were compared, including union of docking site, healing of distraction, and external fixation index (EFI). Major complications associated with these procedures were assessed such as mal-union, nonunion, and recurred infection.

### Results

EFI was significantly shorter in BTOP (12.5 days/cm), comparing to BTON (27 days/cm) ( $P < 0.005$ , Student's t-test). An overall major complication rate of 39% (7 Cases) was observed in the patients treated with BTON; one complication (6%) was identified in those managed with BTOP, a nonunion of distraction callus. Complications after BTON included 4 patients (22%) with mal-union, 2 patients with nonunion of docking site (11%), and 1 patient (6%) with deep infection. All of mal-union developed at the proximal tibia, which was either docking site or osteotomy. Statistical analysis revealed a significant between-group difference ( $P = 0.041$ , Fisher exact test) in the cumulative rate of major complications.

### Conclusion

This study suggests that BTOP for bone defect of tibia results in a significantly shorter time of external fixation and a significantly lower rate of major complication than those of BTON. Then, it should be considered an attractive option in those patients requiring bone transport for the treatment of segmental defect of tibia.

## Minimally Invasive Plate Osteosynthesis in Type C Fibular Fractures Combined with High Energy Lower Leg Injury

Hoon Sang Sohn, Sook-Ha Jeon, Min Soo Shon, Chan Kuk Wi

National Medical Center

### Objective

The aim of this study was to conduct clinical and radiographic evaluation of minimally invasive plate osteosynthesis (MIPO) in type C fibular fracture combined with high energy lower leg trauma including open tibia fracture, pilon fracture, and open injury around ankle joint which must be put at risk of soft tissue problem.

### Methods

From January 2013 to December 2016, 25 patients of type C fibular fracture treated with the MIPO technique were enrolled prospectively. All patients underwent MIPO with either 2.7/3.5 mm anatomical distal fibula plate or 3.5-mm locking compression reconstruction plate according to the level of fibular fracture. Clinical and radiographic outcomes were evaluated using Lower Extremity Functional Scale (LEFS), proportional length difference of fibula, talocrural angle, union rate, operation time, and complications at final follow-up.

### Results

All fractures healed with an average bone healing time of  $22.9 \pm 5.3$  weeks (range, 16-35). The mean proportional length difference was  $0.647 \pm 0.752\%$  compared with the uninjured fibula and the mean talocrural angle was  $79.11 \pm 2.45\%$ . Functional assessment according to LEFS was  $74.0 \pm 3.70$  points (range, 57-80). 19 patients underwent implant removal due to discomfort. Two patients had deep infection in tibia but there was no soft tissue complication regarding fibula fracture. The postoperative superficial peroneal nerve injury was not found in all cases.

### Conclusion

This study showed the MIPO technique in type C fibular fractures combined with high energy lower leg trauma can be one of the useful surgical methods especially considering precarious soft tissue condition in pion fracture and open tibia fracture. A well-planed surgical strategy and skillful reduction technique are also significant to minimize the complication related to MIPO in fibular fracture.

## Immediate Shoulder Exercises Overcome the Shortcomings of the Conservative Treatment in Midshaft Clavicle Fractures

Jungkook Baek<sup>1</sup>, Youngho Lee<sup>2</sup>, Minbom Kim<sup>2</sup>

<sup>1</sup>Armed Forces Medical Command, <sup>2</sup>Seoul National University Hospital

### Objective

Whether the surgical or conservative treatment results in better functional outcome is still debatable. The aim of our study was to evaluate the effectiveness of using conservative treatment with immediate active full range of motion (ROM) shoulder exercises for midshaft clavicle fractures.

### Methods

This was a retrospective study of 99 patients (mean age of 45.1 years) who presented with midshaft clavicle fractures from March 2004 to May 2014. All patients were treated conservatively with immediate active full ROM shoulder exercises. The severity of fractures, union and nonunion rate were measured using radiographs. Functional outcomes were evaluated based on DASH (Disability of the Arm, Shoulder, Hand) score, Constant Shoulder (CS) score and a questionnaires assessing patient's rate of satisfaction.

### Results

The average union rate was 31.4 weeks. There was a statistical correlation between a greater degree of displacement ( $p=0.023$ ) and comminution ( $p=0.035$ ) with a longer average union rate. Simple fractures without comminution showed a high non-union rate ( $p=0.021$ ). Age at the time of injury was statistically significant with functional outcomes ( $p<0.001$ ).

### Conclusion

We highly recommend conservative treatment with immediate active full ROM shoulder exercises as the standard treatment for midshaft clavicle fractures, including those that have been displaced.

## Treatment for Patients with Radial Nerve Palsy Showing the Distraction of Fracture Gap in Transverse Humeral Shaft Fracture

Jungkook Baek<sup>1</sup>, Youngho Lee<sup>2</sup>, Minbom Kim<sup>2</sup>

<sup>1</sup>Armed Forces Medical Command, <sup>2</sup>Seoul National University Hospital

### Objective

Radial nerve palsy associated with humeral shaft fracture (HSF) is known to be the most common nerve lesion complicating long bone fractures. Although there have been some studies on the treatment and prognosis of the radial nerve palsy, but it is still controversial. This study is to investigate clinical outcomes and prognosis of radial nerve palsy with transverse HSF showing distraction of fracture gap.

### Methods

We retrospectively reviewed total 10 cases of the HSF patients who had radial nerve palsy immediately after trauma or who were transferred from other hospital for the same diagnosis from January 2001 to December 2014. All the cases were treated by open reduction and internal fixation with plate and screws, and radial nerves were explored under microscopy. There were 7 men and 3 women, and the mean age at the surgery was 32 years. The follow-up was more than 2 years and most common mechanisms of injury were traffic accidents.

### Results

Every fracture was transverse middle or middle-distal shaft of the humerus in all 10 patients. Mean distraction gap was 9 mm (range, 5-31 mm). Distracted-segmental injury of radial nerve was detected in all radial nerve exploration, and mean size of nerve defect was 10cm (range, 9-12 cm). All injured nerves were treated with autologous sural nerve graft and all fractures were treated with plate. In every case, bone union was achieved, Recovery of motor function was 8 cases of M5 and 2 cases of M4 after nerve graft.

### Conclusion

In case of radial nerve palsy accompanying HSF with distracted fracture gap, there is a possibility of complete transection or long-segmental injury of radial nerve. Therefore, early exploration of radial nerve is recommended, and consider preparing for simultaneous nerve graft due to distracted-segmental injury of radial nerve.

## Analysis of a Survey on Orthopaedic Residency Training for Fracture Treatment in Korea

Yong-Cheol Yoon<sup>1</sup>, Jong-Keon Oh<sup>2</sup>, Jae-Ang Sim<sup>3</sup>, Chang-Wug Oh<sup>4</sup>

<sup>1</sup>Gachon University Gil Hospital, <sup>2</sup>Korea University College of Medicine, Guro,

<sup>3</sup>Gachon University Gil Hospital, <sup>4</sup>Kyungpook National University Hospital

### Introduction

A fracture surgery is the most frequently performed orthopaedic procedure and has been considered as an essential surgery for orthopaedic surgeons in general. Although the method and circumstance of orthopaedic residency training for fracture treatment may differ between countries, the goals of this training, which is to educate the residents regarding the principle of the fracture treatment and foster upright orthopaedic specialists, are still the same. Thus, this study aimed to determine the desirable course of the orthopaedic residency training by investigating and analysing the reality of the training related to fracture surgeries and fracture treatment during orthopaedic residency training of 4th year orthopaedic residents in Korea.

### Methods

Using a questionnaire survey, a one-on-one interview was tried among 266 applicants for the secondary board examination who had finished the entire orthopaedic residency training course; the survey was conducted on January 19, 2016. The responses from 152 applicants (response rate: 57%) who accepted participating in the survey were statistically analysed.

### Results

During the residency training, the residents underwent fracture-related training for 3.5 hours on average per month, and the training was of various forms, including lectures by professors, case briefing, textbook reading, and field training in an operation room. The residents largely differed in terms of experience in conducting fracture surgery: 47 (31%) answered that they never conducted fracture surgery during the training period, whereas 21 (14%) answered that they conducted fracture surgery more than 20 times. Experience in conducting surgery had the best effect in fracture training.

### Conclusion

To improve fracture education among orthopaedic residents in a desirable manner, the professors at hospitals wherein training is conducted should understand the reality of fracture education, dedicate sufficient time for internal and external fracture education, allow residents to conduct fracture surgeries under their supervision, and exert an effort to create a social atmosphere that encourages all three factors.

**Keywords:** Residency training, Fracture, Korea

## **Intraoperative Transcranial Sonography for Detection of Contralateral Hematoma Volume Change in Patients with Traumatic Brain Injury**

Byung Chul Kim, Pil Soo Kim, Seung Han Yu, Jung Hwan Lee, Hyuk Jin Choi

Pusan National University Hospital, Pusan National University School of Medicine, Busan

The authors present two clinical cases, in which intraoperative transcranial sonography (TCS) was used to detect a change in contralateral hematoma volume. A 51-year-old female and a 5-year-old male underwent osteoplastic craniotomy for epidural hematoma removal. Scant contralateral hematoma was evident by preoperative computed tomography (CT) in both patients. Intraoperative TCS was used to detect changes in contralateral hematomas. After observing a volume change in one case, a second operation was performed immediately. Based in this experience, the authors recommend intraoperative TCS for the detection of contralateral hematoma volume changes.

## Determining the Lower Limit of Cerebral Perfusion Pressure in Patients Undergoing Decompressive Craniectomy Following Traumatic Brain Injury

Do-Sung Yoo

The Catholic University of Korea, College of Medicine

### Objective

In the severe traumatic brain injured (TBI) patient, maintaining the systolic blood pressure (BP) over 90 mmHg, the intracranial pressure (ICP) under 20 mmHg and the cerebral perfusion pressure (CPP) greater than 60-70 mmHg is recommended to improve clinical outcomes. But a recommended CPP value for patients treated with decompression craniectomy (DC) is not clearly studied. The authors tried to determine whether the targeted CPP can be lowered in patients with DC.

### Methods

191 patients underwent DC for TBI included in this retrospective analysis. All patients were monitored for ICP and BP during and after the DC. CPP was calculated every two hours after DC. Patient outcomes were evaluated 6 months after the initial treatment.

### Results

The mean age was 50.8 years (median: 52 years, male%: 79.1%), and initial GCS was 6.2 (median 6). Comparing the clinical outcome based on the postoperative ICP over and under 25 mmHg, GOSE was 1.4 (over 25 mmHg) and 4.9 (under 25 mmHg) ( $p=0.000$ ). In patients maintained at ICP under 25 mmHg, the mortality was increased significantly between the CPP 35 and 30 mmHg ( $\chi^2$ ,  $p=0.029$  vs.  $P=0.062$ ).

### Conclusion

TBI patients who underwent DC surgery, if postoperative ICP maintained under 25 mmHg, CPP values above 35 mmHg might be similar in mortality with the CPP value over 60-70 mmHg who didn't underwent DC surgery. The authors suggest that for the TBI patients with DC surgery, targeted CPP might be lowered to 35 mmHg, if the ICP maintained less than 25 mmHg.

# International Symposium 1: Disaster

(Language: English)

**Session Director**

Nam Ryeol Kim (Korea University, Korea)

**Moderator**

Eun Seok Hong (University of Ulsan, Korea)

Chae Hyuk Lee (Armed Forces Goyang Hospital, Korea)

- 
- Global Surgery
  - Advanced Technology in Humanitarian Aid



# Global Surgery

**Tarek Razek**

Mcgill University, Canada

# Advanced Technology in Humanitarian Aid

Nam Ryeol Kim

Korea University, Korea

This session does not contain lecture notes.

## Trauma QI

### **Session Director**

Sung Wook Chang (Dankook University, Korea)

### **Moderator**

Seong Keun Moon (Wonkwang University, Korea)

Min Koo Lee (Cheju Halla General Hospital, Korea)

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### Quality Improvement Program in Trauma Center

- Simple Modification of Trauma Team Activation Criteria
- Simplification of Official Procedures to Reduce ED Stay
- Shortening the Final Decision Time for Severe Trauma Patients
- Trauma Resuscitation in a Trauma Bay: What to Do?
- Activities to Reduce the Hospital Transfer Rate by Controlling Inappropriate Cases of Transfers of Severe Trauma Patients
- Quality Management and Improvement on KTDB
- Quality Improvement Plan



## **International Symposium 2: MTP**

(Language: English)

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Ho-Seong Han (Seoul National University, Korea)

John Cook-Jong Lee (Ajou University, Korea)

- 
- MTP in Japan
  - MTP in Korea



# MTP in Japan

**Yosuke Matsumura**

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

Massive transfusion protocol (MTP) is usually defined as the transfusion ratios of red cells, plasma, and platelets. Although the PROPPR trial concluded no differences between transfusion ratios of 1:1:1 and 1:1:2, it recommended starting with 1:1:1 and modifying according to coagulation status monitored by TEG, ROTEM or coagulation tests. Tranexamic acid was proven to be beneficial for trauma patients in the CRASH-2 trial, and post-partum hemorrhage (PPH) patients in the WOMAN trial. Fibrinogen preparation (off-label use in Japan) enables rapid correction of coagulopathy without excessive volume expansion. Cryoprecipitate contains multiple coagulation factors and is available in approximately 40% of university hospitals in Japan.

Surgery and interventional radiology (IR) have become inseparable measures of “mechanical” hemostasis in the current trauma treatment. Time consciousness is emphasized as seen in the “golden hour” concept, widely accepted in the field of trauma surgery. Time-conscious IR strategy, “Prompt and Rapid Endovascular Strategy in Traumatic Occasion (PRESTO)”, focuses on early activation of IR team, which is advocated in the IR workshop of DIRECT. Meanwhile, MTP plays pivotal role in “Functional” hemostasis, i.e. coagulation management. The need for early MTP can be identified by the “ABC-DEFGS” elements, i.e. Age, Bleeding space/number, Coagulation test, Drug, Event-to-study time, Form of injury, GCS, and Shock, which help to “predict” (earlier than “recognize”) coagulopathy as described in the diagnostic imaging workshop of DIRECT. “Bleeding space” refers to the elasticity of the bleeding tissue to achieve hemostasis, consisting of tight (intramuscular, liver parenchyma without capsular disruption), loose (retroperitoneal space, spleen parenchyma), and free (peritoneal or thoracic cavity) space.

Trauma is not the only condition presenting coagulopathy. PPH is often lethal and MTP must be applied. Trauma, obstetrics, IR, and blood bank should share the MTP concept and conduct collaborative simulations to achieve early activation of MTP and smooth communication for definitive hemostasis.

# MTP in Korea

Sejong Chun

Department of Laboratory Medicine, Chonnam National University Medical School, Gwangju, Korea

Emergency transfusion, in definition, requires prompt action, and can differ from conventional elective transfusion. The difference ranges from omitting routine tests done in conventional transfusion to following certain protocols for transfusion. Massive transfusion is defined by transfusion of massive amounts of blood products in a short period of time to the recipient, and appropriate protocols are known to improve the overall survival of massive transfusion recipients. Domestic consensus regarding emergency and massive transfusion is required. The speaker recently had the opportunity to participate in a government funded project investigating the following;

1. Survey to directors of institutions with substantial records of blood transfusion - The project contains the results of survey regarding emergency and transfusion to representative medical institutes across Korea.
2. Reach of consensus for emergency and massive transfusion - This project included a program that invited personnel in the field of transfusion medicine to an open seminar that summarized the consensus reached for emergency and massive transfusion.
3. Proposal of a standardized manual of procedures for emergency and massive transfusion - The project proposes an emergency and massive transfusion protocol that is fit for application to the Korean medical environment.

# Trauma Video Session 1: Specific Procedures in Trauma

**Session Director**

Dong Hun Kim (Dankook University, Korea)

**Moderator**

Hyo Yoon Kim (Andong Hospital, Korea),  
Kyu-Hyouck Kyoung (University of Ulsan, Korea)

- 
- Bedside Procedure
  - Bedside US-guided PICC Insertion
  - Bedside Percutaneous Dilatational Tracheostomy



# Bedside Procedure

**Dae-Sang Lee**

Department of Trauma Surgery, College of Medicine, The Catholic University of Korea, Seoul, Korea

Ultrasonography is becoming increasingly important because it can be performed directly at the bedside, and its use is increasing, especially in the ICU and ER. A focused ultrasound method that focuses on the part of the organs that you want to see, rather than the ultrasound that is used to diagnose the disease in the ultrasound room is more important in the intensive care unit and emergency room environments. Recently, portable ultrasonic machines have been applied from the prehospital stage. Bedside ultrasound is widely categorized for diagnostic and therapeutic purposes, but it also has two purposes at the same time. Ultrasonography has the advantage of providing immediate and additional information to the medical staff in order to immediately apply the necessary treatment to the patient, since the patient does not move and is performed in the bedside. However, it has a disadvantage that it is more operator-dependent than CT or MRI. However, this can be overcome through repeated training. In addition, the use of this bedside ultrasound in the ICU or emergency room has an advantage in that it can be immediately applied to the patient and immediate therapeutic effect can be expected. However, these bedside procedures may be limited to expecting the best outcomes in terms of having limited resources compared to procedures performed in well controlled and prepared areas such as the operating room or angiography room. Therefore, when performing the bedside procedure, the patient's condition should be considered and the checklist should be applied to make the most profitable decision for the patient.

# Bedside US-guided PICC Insertion

**Eunmi Gil, MD**

Department of Critical Care Medicine & Surgery, Samsung Medical Center,  
Sungkyunkwan University School of Medicine, Seoul, Korea

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

# Bedside Percutaneous Dilatational Tracheostomy

**Dae Sung Ma**

Department of Trauma Surgery, Gachon University Gil Medical Center

Bedside PDT (Percutaneous Dilatational Tracheostomy) in ICU is available and reliable method compared with conventional surgical tracheostomy. There are several different approach for PDT. It is showed the method of PDT in our center. We routinely use “Ciaglia Blue Rhino Percutaneous Tracheostomy introducer Tray” Endotracheal tube is withdrawn to place at the level of T1 on CXR (AP). Operator enters the tracheal lumen below the second tracheal rib above two finger from sternal notch with an introducer needle. Small skin incision after punctured with introducer is made and then serially dilated over a guidewire and stylet. A tracheostomy tube is placed. There are several advantages of bedside PDT. It is considerably shorter than surgical tracheostomy. It is elimination of scheduling difficulty associated with operating room. Also, it need not be transported in critical care patients. It could be performed by minimal members, if need, operator without assistant in bedside.



## **International Symposium 3: Hybrid ER/OR** (Language: English)

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Jae Baek Lee (Chonbuk National University, Korea)

Hyun Min Cho (Pusan National University, Korea)

- 
- Development of the Hybrid ER System in Japan:  
Now is the Time to Spread It Across the Entire Asia
  - Hybrid OR in a Trauma Center of Korea



# Development of the Hybrid ER System in Japan: Now is the Time to Spread It Across the Entire Asia

**Takahiro Kinoshita, MD**

Division of Trauma and Surgical Critical Care, Osaka General Medical Center, Japan

The advanced Trauma Life Support (ATLS) guidelines have been widely accepted as a standardized method of initial management protocols for patients with trauma. However, several studies have reported that computed tomography (CT) examination and interventional radiology (IVR) are effective in hemodynamically unstable patients even though these are not recommended in ATLS guidelines. From these perspectives, we hypothesized that the improvement of access to both CT and IVR would lead to advancements in the management of trauma. In August 2011, we installed an IVR-CT system in our trauma resuscitation room to eliminate transfer time to these kinds of equipment. We named it the Hybrid emergency room (ER) as it enabled us to perform all examinations and treatments required for trauma in a single place.

We conducted a retrospective historical control study included consecutive severe (injury severity score  $\geq 16$ ) blunt trauma patients. Patients were divided into two groups: Conventional (from August 2007 to July 2011) or Hybrid ER (from August 2011 to July 2015). We included 696 patients: 360 in the Conventional group and 336 in the Hybrid ER group. The Hybrid ER group was significantly associated with decreased mortality (adjusted OR, 0.50 [95% CI, 0.29-0.85];  $p=0.011$ ) and reduced deaths from exsanguination (0.17 [0.06-0.47];  $p=0.001$ ). The time to CT initiation (Conventional 26 [21-32] min vs. Hybrid ER 11 [8-16] min;  $p<0.0001$ ) and emergency procedure (68 [51-85] min vs. 47 [37-57] min;  $p<0.0001$ ) were both shorter in the Hybrid ER group (Ann Surg. 2017 Sep 26. [Epub ahead of print]). The results suggested that the novel trauma workflow, comprising immediate CT diagnosis and rapid bleeding control without patient transfer, might improve mortality in severe trauma.

The study contributed to installation of IVR-CT equipment in trauma resuscitation room at 8 major trauma centers in Japan. Now we should discuss whether we could improve outcomes of severe trauma patients by spreading this novel trauma workflow across the entire Asia.

# Hybrid OR in a Trauma Center of Korea

**Ji Young Jang, MD**

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

With the development of interventional radiology techniques for hemostasis in the field of trauma, the first decision to send patients to the operating room or angiography room became important. If preoperative speculation about the source of bleeding is inaccurate and requires different modality, the outcome can be fatal. Hybrid OR systems have recently been introduced in some trauma centers, where surgical operations and angio-embolization can be performed in the same place. However, publications on this subject are very limited. This lecture introduces the early experiences of using the hybrid OR in the Korea Trauma Center and introduces a unique system to overcome the operational limitations of the hybrid OR.

## Trauma Video Session 2: Trauma Surgery

**Session Director**

Dong Hun Kim (Dankook University, Korea)

**Moderator**

Jung Joo Hwang (Eulji University, Korea)

Jung Chul Kim (Chonnam National University, Korea)

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- Trauma Surgery of Abdomen
- Organ Specific Tips in Trauma Laparoscopy
- Specific Bleeding Control in Damage Control Surgery



# Trauma Surgery of Abdomen

**Seung Je Go**

Department of Trauma Surgery, Trauma Center, Chungbuk National University Hospital, Cheongju, Korea

Abdominal injuries for trauma are caused by blunt and penetrating injury and mainly damaged by blunt trauma in Korea. Indications for surgery in abdominal injuries are largely large amount of hemoperitoneum and pneumoperitoneum. Of course, there are quite many cases what both injuries present at the same time.

Injuries of the solid organs, the mesentery, and the major blood vessels in the abdominal cavity cause large amount of hemoperitoneum and can lead to death. The pneumoperitoneum by trauma is often accompanied with the hemoperitoneum. But, if the hemoperitoneum do not progress anymore, the death by the pneumoperitoneum itself is rare.

In trauma surgery of the abdomen, all patients should have both thorax and abdomen prepared and draped to access to the thorax, abdomen and groins if required. Then, the incision is performed from the xiphoid process to the symphysis pubis. As soon as the abdominal wall has been opened, much blood and hematoma is first evacuated outside the abdominal cavity. And the small bowel is also eviscerated outside the abdominal cavity, a rapid exploration was done to find an obvious site of large amount of bleeding.

The surgeon proceeds to pack dry gauzes at the 4 quadrants such as perisplenic, perihepatic, and both paracolic gutters and remove the abdominal pack of gauzes, one at a time, starting in the area least likely to be the site of the bleeding. The hemostatic procedures can be different each other depending on the amount and location of bleeding sites. Also no other procedures must be performed priority until control of bleeding. The damage control surgery can be considered if the control of bleeding is not resolved with immediate procedures.

# Organ Specific Tips in Trauma Laparoscopy

Hangjoo Cho

Uijeongbu St. Mary's Hospital, The Catholic University of Korea, Korea

Minimally invasive surgery (MIS) is now widely used in all surgical field except for trauma surgery. This is because MIS have several disadvantage including increased possibility of missed injury & bowel injury, increased IICP, more time consuming, greater chance of gas embolism. If missed injuries were occurred or time to bleeding control is delayed, the patient's survival was threatened. However, MIS have extinguished benefits including improved cosmesis, low tissue desiccation, lower chance of post-operative paralytic ileus and so on.

Laparoscopic trauma surgery (LTS) is divided into two classes, diagnostic & therapeutic.

## Diagnostic laparoscopy

Diagnostic laparoscopy is used for sparing non therapeutic laparotomy. Especially in cases with abdominal stab wound with proven or equivocal penetration of fascia, suspected intraabdominal injury after blunt trauma, diagnosis of diaphragmatic injury from penetrating trauma to the thoracoabdominal area. Sensitivity, specificity, diagnostic accuracy of diagnostic laparoscopy range from 75% to 100%.

## Therapeutic laparoscopy

Laparoscopic repairs of injuries to every organ have been described. Injuries to diaphragm, parenchyma organ and gastro-intestinal tract have been successfully repaired laparoscopically. Patients who continue to bleed following embolization can be treated with laparoscopy by topical hemostatic agent or even splenectomy. Small laceration of stomach, duodenum, small bowel, colon can be repaired laparoscopically. Sometimes an anastomosis or a long repair are usually performed extracorporeally through a small focused celiotomy. Diaphragmatic hernia (esp. Lt.) can be repaired successfully by various laparoscopic suture techniques.

## Contraindication

Hemodynamic instability is currently the absolute contraindication for laparoscopy. Concomitant severe traumatic brain injury also exclude laparoscopy because of increased intracranial pressure.

## Conclusion

Position of laparoscopic surgery in trauma field is between laparotomy and observation. Because of innovative development of laparoscopic instruments, almost all surgery can be conducted by laparoscopic method. Role of laparoscopy in trauma will be increased also in trauma surgery. If the patient's vital sign is stable, laparoscopic methods can be applied, however we should be careful about missed injury.

# Specific Bleeding Control in Damage Control Surgery

**Dong Hun Kim**

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

We demonstrate various damage control procedures or definitive surgical skills through video clips as follows

1. General damage control algorithm proceeded to a definitive surgery (right hemihepatectomy)
2. Perihepatic packing - definitive bleeding control
3. Atriocaval shunt for retrohepatic IVC injury in swine model
4. Lateral venorrhaphy for infrahepatic IVC injury
5. Renorrhaphy for grade IV renal injury
6. Primary repair & Roux-en-Y duodenojejunostomy for duodenal 3rd portion injury
7. Laparotomy following preperitoneal pelvic packing for both abdomen and pelvic injury
8. Crash laparotomy with Zone I REBOA for spleen rupture
9. Hemipelvectomy with Zone III REBOA for unstable pelvic injury



## Luncheon Seminar 2

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Jinyoung Park (Kyungpook National University, Korea)

- 
- Disseminated Intravascular Coagulation in Trauma



# **Disseminated Intravascular Coagulation in Trauma**

**Hangjoo Cho**

The Catholic University of Korea, Korea



## Special Lecture Session 2: System

**Session Director**

Chan Yong Park (Wonkwang University, Korea)

**Moderator**

Sung Hyuk Choi (Korea University, Korea)

Sang Do Shin (Seoul National University, Korea)

- 
- Evaluation of Preventable Trauma Death Rate in Korea
  - EMS-Assessed Mass Casualty Incident/Severe Trauma Database of Korea



# **Evaluation of Preventable Trauma Death Rate in Korea**

**Yoon Kim**

Seoul National University, Korea

# EMS-Assessed Mass Casualty Incident/Severe Trauma Database of Korea

**Kyoung-Jun Song**

Seoul National University Hospital, Korea

Korean CDC developed emergency medical services-assessed mass casualty incident (MCI) / severe trauma (ST) database. This database was made by medical record review about patients registered into EMS based severe trauma patients from 2011. We will review baseline characteristics of this database and will discuss about main results from regional, EMS, hospital indices.

## **Debate Session: Multidisciplinary Collaboration**

**Session Director**

Chang Ho Jeon (Pusan National University, Korea)

**Moderator**

Je Hwan Won (Ajou University, Korea)

Chan Yong Park (Wonkwang University, Korea)

- 
- Duet Presentation 1 (Gachon University, Korea)
  - Duet Presentation 2 (Mokpo Hankook Hospital, Korea)
  - Duet Presentation 3 (Pusan National University, Korea)
  - Discussion
  - Panelists
    - Hwan Jun Jae (Seoul National University, Korea)
    - Chang Won Kim (Pusan National University, Korea)
    - Hangjoo Cho (The Catholic University of Korea, Korea)
    - Byungchul Yu (Gachon University, Korea)



# **Duet Presentation 1** **(Gachon University, Korea)**

**Gil Jae Lee & Jeong Ho Kim**

## Duet Presentation 2 (Mokpo Hankook Hospital, Korea)

**Bo-Ra Seo, MD, Yong Tae Kim, MD**

Departments of Neurosurgery, Radiology, Mokpo Hankook Hospital

### **Penetrating Carotid Artery Injury**

The standard management is immediate surgical exploration for patients who present with signs and symptoms of shock and continuous hemorrhage from the neck penetrating injury (especially zone II neck injury). Proper exposure to gain adequate proximal and distal control of the involved blood vessels for the surgical exploration. However, active arterial bleeding and compressing hand of assistant for reducing the bleeding disturbs surgical field.

To overcome these disadvantage, we performed endovascular treatment as a initial treatment option in penetrating carotid artery injury.

In this presentation, we reviewed three cases of penetrating carotid artery injury and would like to discuss therapeutic options.

## Duet Presentation 3 (Pusan National University, Korea)

Kwang Hee Yeo & Hoon Kwon

The 6<sup>th</sup> PPTC

### Multidisciplinary Collaboration Pusan National University Hospital

Kwang Hee Yeo<sup>1</sup>, Hoon Kwon<sup>2</sup>

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

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

**PNU** 부산대학교병원

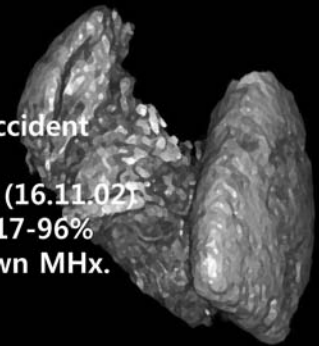
### Case M/38

Motorcycle traffic accident

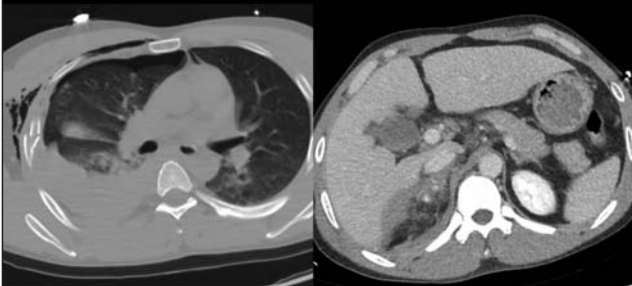
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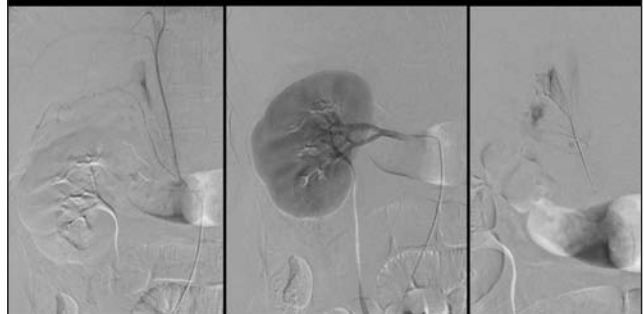
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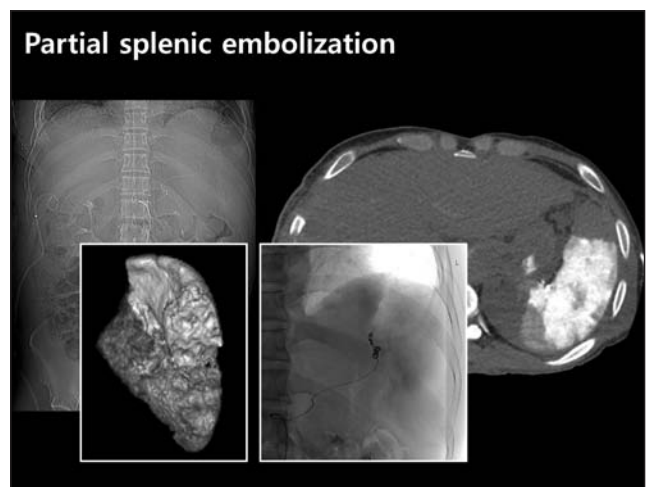
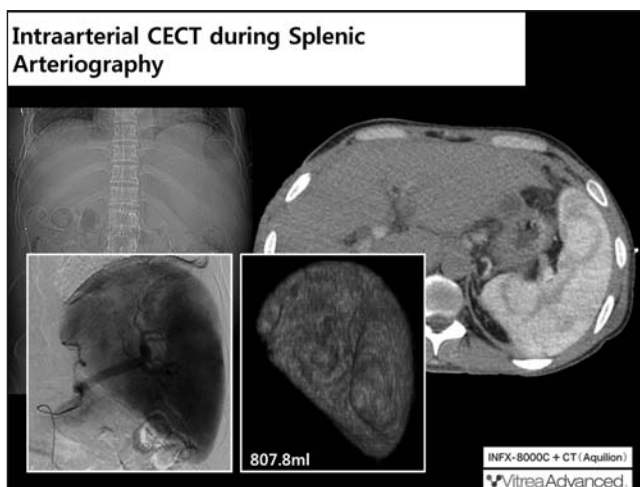
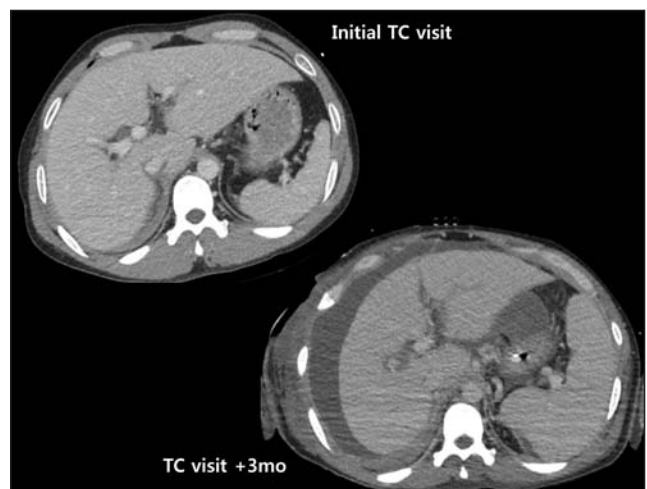
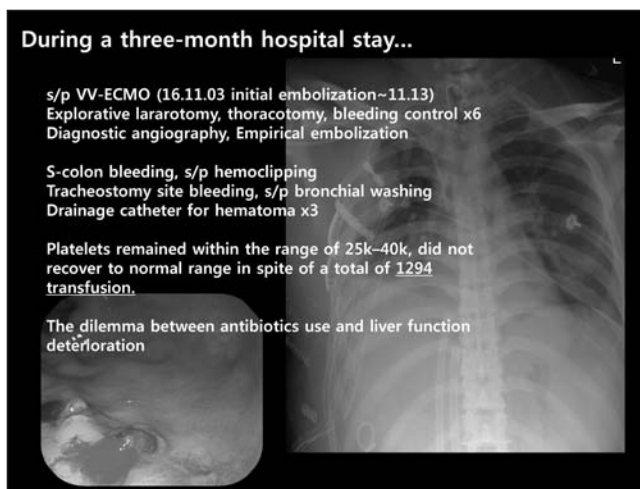
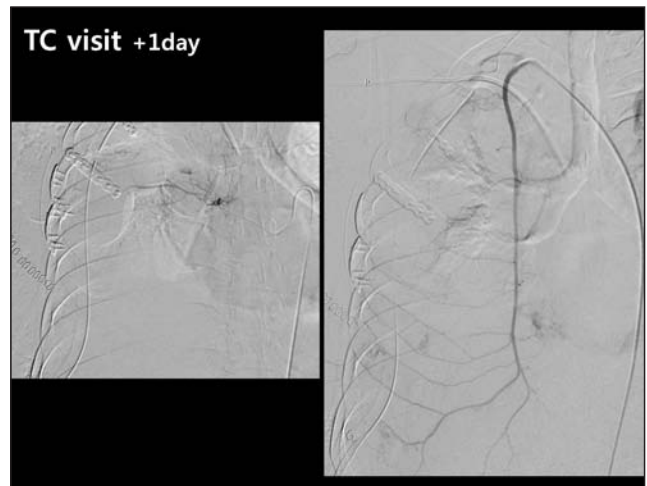
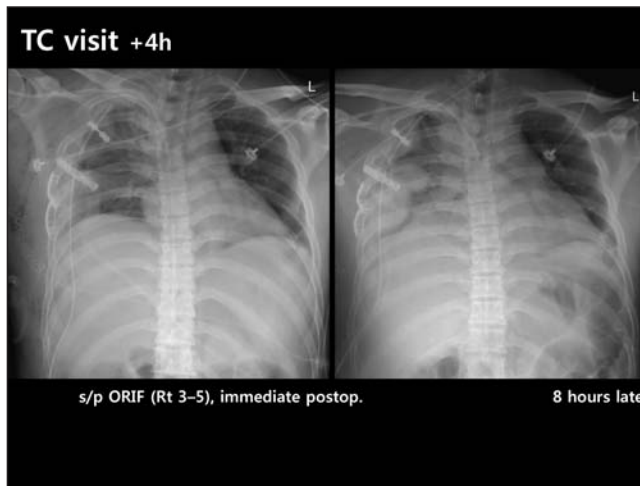


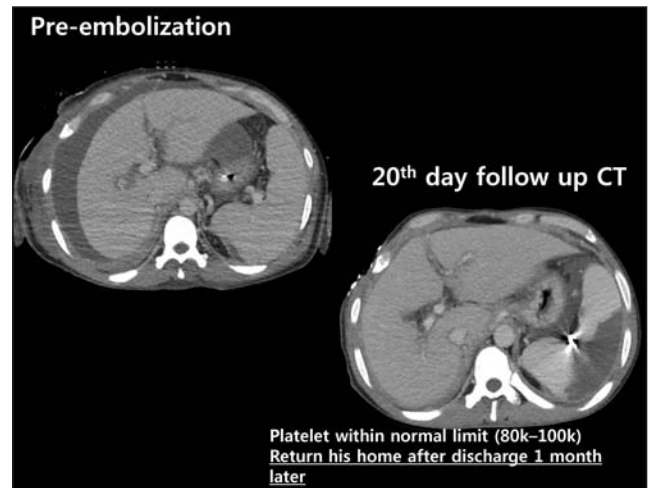
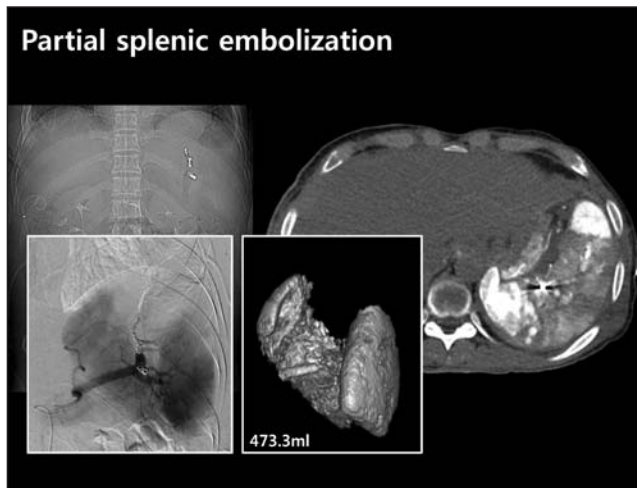
TC visit +40min (11A39)



TC visit +2h (01P02)









## Oral Session 7: Polytrauma

**Session Director**

Nam Ryeol Kim (Korea University, Korea)

**Moderator**

Jung Nam Lee (Gachon University, Korea)

Nam Ryeol Kim (Korea University, Korea)

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- Gun Shot Injury
- Oral Presentation (OP7)



# Gun Shot Injury

**John Cook-Jong Lee**

Ajou University, Korea

## **The Management of Stab Injury on Torso: A Single Trauma Center Experience**

Kang Kook Choi

Gachon University Gil Medical Center

### **Objective**

The stab injury is the most common cause of penetrating injuries in Korea. The surgical exploration was mandatory for the peritoneal penetration. However, selective management has been adapted for the peritoneal penetration recently. Therefore, the aim of the study is to elucidate the usefulness of the selective management for the stab injury.

### **Methods**

We performed retrospective review of the stab injury for 5 years.

### **Results**

A total 122 stab injury were enrolled. Surgical exploration was performed for 56 patients. 24 patients got multiple injuries. Overall mortality was 14.3%. The success rate of selective management was 96.6%.

### **Conclusion**

Selective management was useful for the torso stab injury. However, further prospective study was needed.

## Experiences of a Disaster Medical Assistant Team (DMAT) in Fire Disaster at Jecheon Sports Complex Center: Limitation and Importance of Rescue

Woo Jin Jung, Seung Gyo Jung

Wonju Severans Christian Hospital, Yonsei University

### Objective

This study was to analyze the progress of fire disaster at Jecheon sports complex center and assess the adequacy of DMAT (Disaster Medical Assistant Team)'s activities in response to fire disasters.

### Methods

We conducted retrospective study based on camera recordings and medical records that were recorded on disaster site for assessment of activities. We had cooperated with firefighters, police officers, local hospital medical staffs and public health personnel in order to classify patients in the disaster field and to understand the progress of the patients.

### Results

At 15:52, there was a first request for emergency rescue to the 119 general emergency call center, and a request of DMAT activation was made at 16:28. Two Wonju DMATs arrived at the site at 17:04 and had activity to the following day until 00:43. Total number of the casualty was 60, including 27 minimal (Green) patients, 29 expectant (Black) patients and 4 delayed (Yellow) patients. There were 32 patients who had treated on-site care by DMAT team, and 28 patients were transferred via local EMS or visited the local hospital on their own foot before the DMAT team arrived. DMAT staffs administered high concentration Oxygen therapy to the 3 delayed (yellow) patients who had gas inhalation injury, and instructed to transfer to the local hospital. Two patients were transferred to Hyperbaric oxygen treatment center in Wonju Severance Christian Hospital from local hospital in Jecheon. Of the 29 mortality, 20 victims were found dead on the second floor of the sports complex building.

### Conclusion

Twenty-nine victims were found in the sports complex building, and 31 were injured patients. The main cause of death is thought to be smoke suffocation. Although the two Wonju DMAT were dispatched to the site relatively quickly, it was difficult to effective DMAT activity due to late rescue and fire suppression.

## Analysis of Injury Mechanism of the Elderly and Non-Elderly Groups in Motor Vehicle Minor Crash Accidents

Joong Seok Kong, Kang Hyun Lee, Oh Hyun Kim, Hyun Youk, Hee Young Lee, Chan Young Kang, Sil Sung

Wonju College of Medicine, Yonsei University

### Objective

The purpose of this study is to analysis the effect of a minor impact on the injury mechanism of elderly and non-occupant occupants.

### Methods

This study was conducted on 359 patients who visited the level 1 regional trauma center during a traffic accident in three cities from January 2011 to November 2017. The Patients were divided into non-elderly group (age under 65) and elderly group (above age including 65) in this study. Minor accident criteria using J224 Collision Deformation Classification codes were used to demonstrate a minor accident criterion which was established by the Society of Automotive Engineers. Also, Minor accident damage type guideline were used which has presented from Korea Automobile insurance Repair & Training Center (KART) of Korea Insurance Development Institute (KIDI).

### Results

Among the 359 patients who were injured in minor vehicle accidents, 43 patients (11.98%) accrued severe injuries. Vehicle type variations in non-elderly patients by minor crash accidents were Sedan 192 (65.54%), SUV 77 (21.45%), Light Truck 19 (6.19%), and Van 19 (6.19%). In elderly group, Sedan 32 (61.54%), SUV 10 (19.23%), Light Truck 5 (9.62%), and Van 5 (9.62%) has been occurred. For severe injury occurrence between aged groups, non-elderly groups for 11 patients(10.75%) and 33 patients (19.23%) were found to be above 3 points of AIS among minor crash accidents. In detail, the highest injury parts over AIS 3 in non-elderly group were made in the chest (39.39%), head (38.36%), Cervical Spine (9.09%) in order. However, elderly group's highest injury parts were chest (60%), cervical spine (20%), head and abdomen (10%).

### Conclusion

In conclusion, minor crash injury do affects severe injury in motor vehicle accidents. Also, elderly groups had a higher severity of injury more than the non-elderly groups. Regardless of aged groups, the highest severity of injury was found in the chest.

## The Clinical Implications of Severe Low Rib Fracture in the Management of Diaphragm Injury

Seongyup Kim, Il Hwan Park

Yonsei Wonju College of Medicine

### Objective

The objective of this study was to analyze the differences in clinical presentation and characteristics with regard to diaphragmatic injury between blunt trauma patients with severe low rib fractures and those without severe low rib fractures.

### Methods

The medical records of all patients with diaphragmatic injuries who were surgically treated at this level I trauma center, between January 2004 and December 2016 were reviewed. Patient notes, radiologic findings, and operative reports were evaluated. All of the diaphragmatic injuries were confirmed based on the operative findings. Rib fracture with displacement between the ends of the fracture of more than half the width of the fractured rib on computed tomography was classified as 'severe rib fracture'. Patients were categorized into 2 groups and analyzed: those who had more than one severe rib fracture in low ribs on the ipsilateral side of the diaphragm injury (Severe group), and those with no severe rib fracture (Non-severe group).

### Results

Delayed diagnosis of diaphragmatic injury was more frequent in the Severe group than in the Non-severe group (81.8% vs 36.8%, p-value = 0.026). With regard to initial indications for operation, intrathoracic visceral herniation was more frequent in the Non-severe group (78.9% vs 18.2%, p-value=0.002), while hemothorax was more frequent in the Severe group (63.6% vs 5.3%, p-value=0.001). Central type diaphragmatic laceration was more frequent in the Non-severe group than in the Severe group (78.9% vs 18.2%, p-value=0.002). The diameter of diaphragmatic injury was larger in the Non-severe group than in the Severe group ( $9.70 \pm 4.10$  cm vs  $4.80 \pm 3.60$  cm, p-value=0.004).

### Conclusion

The results of this study imply that a low threshold for thoracotomy or laparotomy should be considered in blunt trauma patients with severe low rib fractures for the purpose of hidden diaphragmatic injury detection and management.

## Pelvic Fracture Type as a Risk Factor for Mortality in Patient with Pelvic Fractures

HoeJeong Chung, Hye Youn Kwon

Yonsei University Wonju College of Medicine

### Objective

Pelvic fractures are caused by high energy trauma. Pelvic fractures have a high mortality rate. There are many previous studies on factors contributing to the mortality rate of pelvic fractures, but there are still controversies. We hypothesized that the instability of pelvic fractures can be a risk factor for the mortality, and investigated the effect of pelvic fracture type on mortality through the patients admitted to our Level I Trauma center.

### Methods

A total of 302 pelvic fracture patients were included based on Korean Trauma Data Bank from March 2015 to February 2017. We compared demographics of these patients according to survival and death, and investigated the risk factors related with mortality in patient with pelvic fractures. We classified the patients into three groups- pelvic ring injury (PRI), only acetabulum fracture and combined fracture type.

### Results

Among 302 patients with pelvic fracture, 195 (64.6%) were PRI, 75 (24.8%) were only acetabulum fracture and 32 (10.6%) were combined fracture type. The mortality rate of PRI and combined fracture type was 22.6%, 18.8% respectively, while the mortality rate of only acetabulum fracture was 1.3% ( $p<0.001$ ). In the subgroup analysis of PRI, the mortality rate of PRI AO comprehensive classification type A, type B and type C was 8.2%, 25.4% and 68.2%, respectively ( $p<0.001$ ). The Multivariate regression analysis revealed that old age (OR=1.043, 95% CI 1.009-1.078,  $p=0.013$ ), high injury severity score (OR=1.106, 95% CI=1.047-1.168,  $p<0.001$ ), low initial systolic blood pressure (OR=0.952, 95% CI=0.936-0.967,  $p<0.001$ ) and PRI (OR=22.28, 95% CI=1.180-420.513,  $p=0.038$ ) were significant risk factors for mortality.

### Conclusion

PRI is a significant risk factor for mortality compared to only acetabulum fracture patients. Pelvic injury type and its instability as well as age, injury severity score, initial systolic blood pressure must be considered for management of multiple blunt trauma patients with pelvic fracture.

## Strategies for the Management of Hemodynamically Unstable Pelvic Fractures: From Preperitoneal Pelvic Packing to Definitive Internal Fixation

Hyung Keun Song

Ajou Trauma Center

### Object

Exsanguinating pelvic fractures are still associated with a significant mortality rate of 28-60%. Preperitoneal pelvic packing (PPP) has been proposed as an optimal method of early hemorrhage control. However, the timing of definitive internal fixation of unstable pelvic fractures remains a topic of debate. We studied hemodynamically unstable pelvic fracture patients who underwent definitive internal fixation followed PPP.

### Methods

After PPP, resuscitation and correction of the coagulopathy were conducted in the intensive care unit. Packed surgical pads were subsequently removed within 48 hours. At the time of pad removal, definitive internal fixation was done.

### Results

During the 4-year study, 26 patients with hemodynamic instability caused by pelvic fracture were enrolled in this study. The mean age was 50.5 years (30-85 years) and the mean ISS was 30.1 (13-66). 11 patients were acetabular fractures, and 15 patients were pelvic ring injuries. Among the pelvic ring injuries, 11 patients were APC type and 4 patients were LC type. Time from injury to definitive internal fixation was average 1.8 days (1-4 days). Complications including pneumonia, deep vein thrombosis, superficial and deep wound infection occurred in 9 patients. All fractures were united.

### Conclusion

Hemodynamically unstable pelvic fractures are characterized by mortality and complications. Definitive internal fixation at that time of PPP removal was relatively effective and safe.



## **Panel Discussion: Evidence-Based ICU Care**

**Session Director**

Ye Rim Chang (Dankook University, Korea)

**Moderator**

Jae Gil Lee (Yonsei University Severance Hospital, Korea)

Hangjoo Cho (The Catholic University of Korea, Korea)

- 
- Nutrition
  - PAD
  - Evidence based Management in ICU - Fluid, AKI, DVT



# Nutrition

Pil Young Jung

Yonsei University Wonju College of Medicine

## 본원의 영양지원 현황



## NST(Nutrition Support Team)

### 정의

- 영양지원이라 함은 경구섭취가 부적절하거나 불충분한 환자에게 경장영양(enteral nutrition) 또는 정맥영양(parenteral nutrition)을 공급하는 것을 말한다.

## 팀구성원의 역할

- 의사 : 환자에 대한 전반적인 책임
- 영양사 : 영양상태평가, 요구량 산정, 영양공급계획
- 약사 : PN제제, 약물, 영양소 상호작용 평가
- 간호사 : 모니터링(Catheter 관리, 관찰)

## NST 구성원

구분	의사	간호사	약사	영양사
외과	심홍진 류훈 정필영 장지영	이규자	조현주 오은숙 전계형 고아라	연현주(전담) 심은영 심재윤 이용미
신경외과	오지웅 김소현			
내과	임정수 이석정			
소아과	김용혁			
재활의학과	김지현			

## NST의 효과

- 영양에 대한 체계적, 전문적 service
  - 치료효과↑, 합병증, 사망률, 재원기간 ↓
- 경제적 영양지원
  - 불필요한 영양액의 공급방지
  - PN & EN 처방의 표준화
  - 적절한 영양지원 방법 및 기구와 처방의 선택

## 본원 NST의 영양중재

- 현재식사량 또는영양공급량(kcal, 단백질,당질)
- 영양상태 판정(양호함, Marasmus-type, Kwashiorkor-type, 심한 PCM, 보통의 PCM, 경미한 PCM)
- 1일 영양요구량(kcal, 단백질)
- Plan: overfeeding, underfeeding, refeeding syndrome여부(질환에 따라 영양공급상의 많고 부족한 영양분을 조정).  
aspiration, diarrhea, constipation문제 조정

표. ICD-9에 기초한 PEM(Protein-Energy Malnutrition)구분

영양지표	Kwashiorkor (ICD980, KCD E40)	Marasmus (ICD981, KCD E41)	심한 PCM (ICD 262, KCD E42 E43)	보통의 PCM (ICD263.0, KCD E44)	경미한 PCM (ICD263.1, KCD E44.1)
%요른체중		<80	≤80	60-75	75-90
%최소중량소	≤10	>20	>10	>15	10-15
Albumin (g/dl)	<2.5	≥2.5	<2.5	≤3.2	≤3.2
특징	영양결핍에 의한 부종, 신부종 및 신장기능의 dysregulation	semi-starvation, 심한 영양결핍	영양결핍에 의한 부종, 신부종 및 신장기능의 dysregulation이 없음	Mixed marasmus with hypoalbuminemia	Mixed marasmus with hypoalbuminemia

\*ICD: International Classification of Diseases, KCD: Korean Classification of Diseases  
Adapted from: JADA, A Proposed revision of current ICD-9-CM malnutrition code definitions, 1996, 96:320-323

## How much calories ?

- Calorie requirement = 25kcal/kg/day
  - Protein = 1.2 - 1.5g/kg
- <recommended by ESPEN, ASPEN >

Malnutrition : IBW < actual body weight

Obesity : IBW > actual body weight

## Hypocaloric feeding의 고려대상

- Obesity (BMI >40)
- Refeeding syndrome risk
- Severe malnutrition
- COPD(만성폐쇄성 폐질환)
- ARDS(급성호흡곤란증후군)
- Hypercapnia
- Hyperglycemia
- Hypertriglyceridemia

## Underfeeding vs. Overfeeding

Underfeeding	Decreased respiratory muscle strength Impaired organ function Immuno suppression Poor wound healing Increased risk of nosocomial infection Low transport protein levels Failure to wean from mechanical ventilation
Overfeeding	Hyperglycemia Hypertriglyceridemia Azotemia Electrolyte imbalance Immuno suppression Hepatic steatosis Fluid retention Failure to wean from mechanical ventilation

## NST의 활동기록



## NST의 시작

2007.6.27

- 영양지원팀 구성
- NST consult 시행(2008년~)



## NST consult 시행(2008년~)



## 2011년 4월 10일 ~



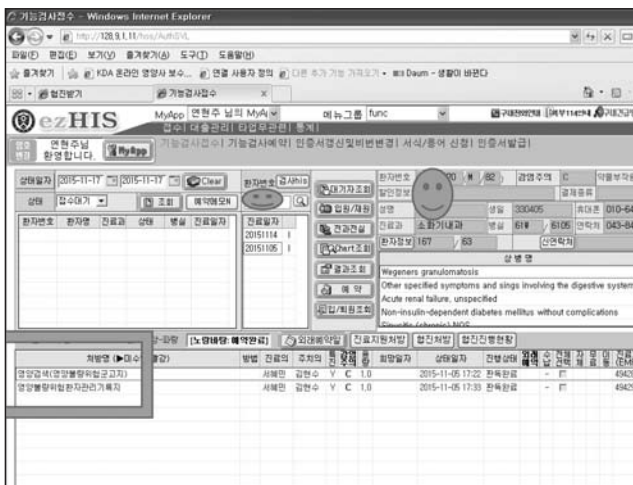
## NST의 시작

2014.08.01

- 집중영양치료료 신설
- (NST CONSULT수가: 36,870원)

2014.08.19

- 전담영양사 선정
- (NST CONSULT수가 받기 시작)



## 집중영양치료로 신설(2014. 8. 1)

- 집중영양치료로는 담당의사의 처방을 받아 영양집중치료팀이 집중영양치료를 실시하고 그 내용을 의무기록에 기록한 경우에 산정하되, 몇가지 요건을 모두 충족한 경우 요양급여를 인정함.
- 팀원 중 1인 이상은 집중영양치료 업무만을 담당하여야 함.
- 상급종합병원 36,870원/1회



## 2014년 7월 30일 ~현재



## NST 활동기록

2014.8.27

- 자동으로 팝업 창 뜨도록 중환자 위원회에 의견 상정.(전산팀 의뢰)

2014.09.17

- NST CONSULT 처방 증가
- 1일 3건 -> 30건으로 증가

2014.11.19

- 병동 팝업창 없애고 중환자실만 팝업창 유지

## NST 활동기록(펌프)



## Enteral feeding 펌프 공급 유의사항

1. jejunostomy feeding시 사용
2. 12-24시간 공급
3. step1 25ml/hr over 16시간 - 500ml  
step2 50ml/hr over 16시간 - 800ml  
step3 75ml/hr over 16시간 - 1200ml  
step4 100ml/hr over 16시간 - 1600ml  
step5 125ml/hr over 16시간 - 2000ml  
=>주입속도가 100ml/hr이상 시 tolerable하면 Gravity drip feeding가능.  
=>환자가 복부 불편감 있을 시 이전 속도로 줄임.  
=>주입속도는 1일 1회 증량 권장.
4. 4시간마다 미지근한 물 30cc로 flushing을 해야 관 막힘 방지

### NST 활동기록(펌프)

- 2014.04.15
  - ENTERAL PUMP 등록
  - 1일당 40,000원
  - 펌프 구입 신청
- 2015.05.21
  - 보험수가코드 등록: ENTERAL PUMP 등록
  - 1일당 1,900원 추가 수납
- 2014.12.16
  - 현재 펌프 17대를 보유 (TICU 4대, EICU 4대, MICU&NSICU 4대, SICU 2대, 영양팀 2대, 52병동 1대)

### 주2회 NST 회진 및 컨퍼런스

- 2015.03.01
  - 회진 대상 TICU, EICU, MICU, NSICU로 확대(주2회)
  - 영양집중지원팀 의뢰환자의 영양지원 경과



### 월1회 NST 학술모임



### NST KASPEN 인증 기록

- 2012.8-2014.7
  - 한국정맥경장영양학회 [원주세브란스기독병원] 3년 1차인증 통과
- 2014.8-2017.7
  - 한국정맥경장영양학회 [원주세브란스기독병원] 3년 2차인증 통과



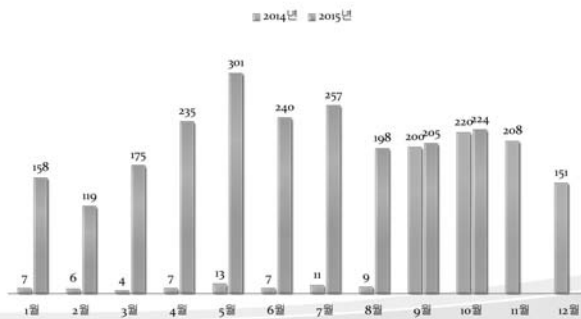
### NST 시행 건수

구분	연통계	월평균
2008년	16	1.3건
2009년	45	3.8건
2010년	42	3.5건
2011년	64	5.3건

### NST 시행건수

구분	연통계	월평균	연수입
2012년	121	10건	-
2013년	105	8건	-
2014년	843	70건	29,053,560
2015년	2112(10월까지)	211건	79,221,120 (10월까지)

## NST 2014/2015년 의뢰건수



## Feeding pump 사용 현황

구분	연통계	월평균
2015년	5월	18건
	6월	69건
	7월	161건
	8월	208건
	9월	178건
	10월	170건
total	1일당 산정	804건(1,527,600원)

## comparison between 2014 and 2015

	2014 (n= 770)	2015 (n = 719)	P-value
Age (year)	63.6 ± 17.5	63.4 ± 17.6	0.769
Gender (male)	60.8%	60.1%	0.784
Hospital stay (day)	19.6 ± 19.0	21.9 ± 21.2	0.022
ICU stay (day)	5.1 ± 6.2	5.9 ± 7.3	0.034
Mortality (%)	19.4%	20.2%	0.693
Number of NST consultation (%)	3.4%	54.2%	< 0.001

\*100일 이상 장기 재원환자는 제외하였음.

## number of NST consultation according as intensive care unit in 2015

Unit	EICU	MICU	NSICU	SICU	TICU	p-value
Rate of NST consultation	58.7%	63.0%	75.6%	29.1%	61.5%	0.009

Result of linear by linear

## 경청해주셔서 감사합니다.



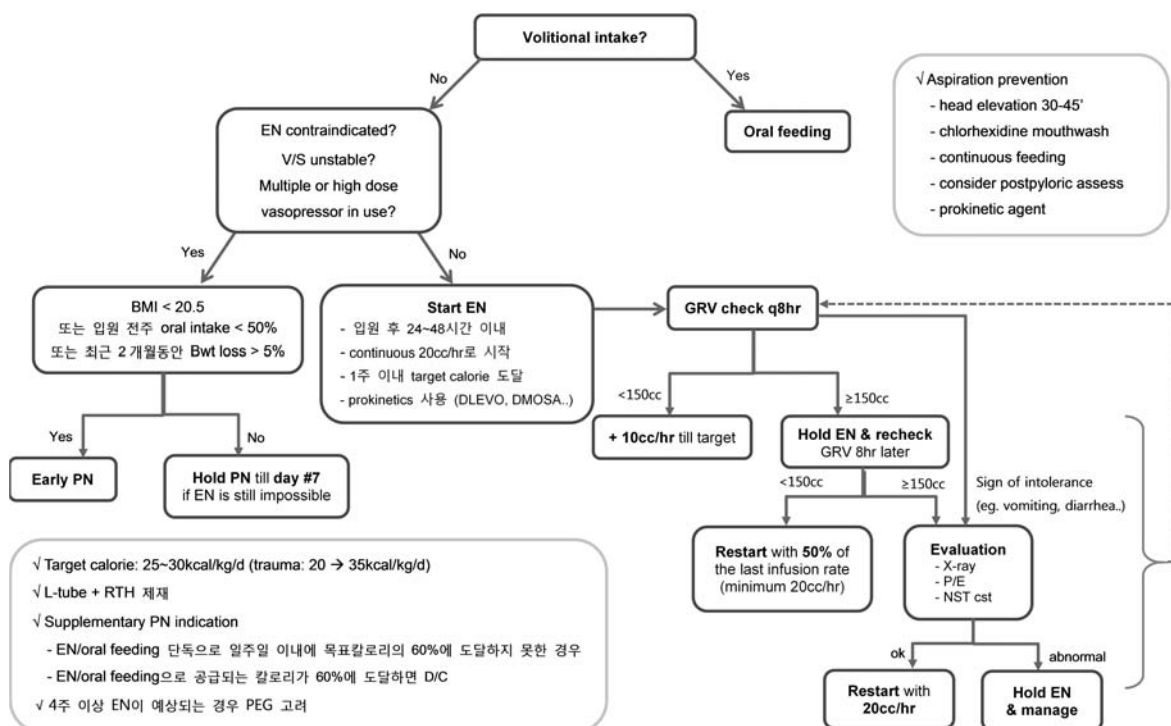
# DKUH Nutritional Protocol

Ye Rim Chang

Dankook University Hospital

Early enteral nutrition (EN) has been shown a significant reduction in morbidity and mortality compared to other nutritional support. Multi-strategy nutritional protocol was developed based on the evidences and recommendations of 2016 ASPEN (American Society for Parenteral and Enteral Nutrition) guideline, 2013 Canadian guideline, 2013 DGEM (German Society for Nutritional Medicine) guideline, ESPEN (European Society for Clinical Nutrition and Metabolism) guidelines, and several textbooks for patients in the intensive care unit (ICU) of Dankook University Hospital. The protocol was implemented through 2016. Repeated educations and conferences were conducted to nurses, residents, and physicians of various department working for ICU patients. Electrical process was also simplified to encourage consultation to nutrition support team. The duration of fasting was decreased to 5.4 days on 2017 compared to 6.5 days on 2015. The incidence of percutaneous cholecystostomy due to acute acalculous cholecystitis were significantly decreased after the implementation of nutritional protocol ( $p=0.023$ ).

## DKUH Nutrition Protocol (ver 1.3)



# **Pain, Agitation and Delirium (PAD) Protocol in Trauma ICU of DKUH**

**Dong Hun Kim**

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

Sedatives and analgesics are among the most commonly administered medications in mechanically ventilated intensive care unit (ICU) patients. Maintaining a deep level of sedation is associated with a longer duration of mechanical ventilation, longer ICU length of stay, and increased acquired weakness from immobility. Contemporary guidelines, therefore, aim for lighter sedation targets as they have now been associated with improved patient outcomes. Patient sedation needs are closely associated with pain, agitation, and delirium (PAD), and oversedated patients may suffer from delayed diagnosis of these closely associated processes. The interrelated concepts of pain, agitation, and delirium confirm the need for a bundled approach to identification and treatment. ICU sedation protocols can be used to maintain patient comfort while decreasing practice variation and cumulative sedative exposure. by using validated and targeted scales in a systematic, integrated, and stepwise fashion with an analgesia-first approach, the judicious use of benzodiazepine sedatives, reduction of continuous infusions, and the promotion of early physical therapy lighter sedation can be successfully achieved. Implementation of the evidence-based PAD guideline is feasible through ICU checklist.

# **PAD Protocol for Trauma Patients**

**Min A Lee**

Gachon University Gil Medical Center, Korea

Management of pain, agitation, and delirium (PAD) in patients with severe trauma is important.

In our center, we established the PAD protocol for severe trauma patients and applied it to patients in the traumatic intensive care units. We will share our experience of managing patients with the protocol.

# Evidence based Management in ICU - Fluid, AKI, DVT

**Ahram Han**

Seoul University College of Medicine, Korea

## **1. Fluid management**

The main controversies of the fluid management in trauma intensive care unit is (1) the circumstances, (2) the optimal product and (3) the amount of fluid need to be given. We will describe the fluid management strategies recommended by the recent research and guidelines. The main elements of the strategy are (1) to initially assess whether the patient needs further fluid resuscitation, (2) to use balanced solutions or isotonic saline in respect depending on the metabolic and other endpoints, and to (3) allow permissive hypotension if definitive bleeding control has not been achieved, and adjust the amount of fluids according to the dynamic indices of volume status after the resuscitation phase.

## **2. Acute kidney injury (AKI)**

The rate of severe acute kidney injury (KDIGO stage 2-3) in trauma patients has been reported to be as high as 9-26%. Risk factors of AKI in trauma patients are age, comorbidities, hemorrhagic shock, and the severity of rhabdomyolysis. There are no specific recommendation regarding AKI in trauma patients. We will discuss about the KDIGO guideline of the management of AKI in general, and especially focus on the management of rhabdomyolysis.

## **3. Venous thromboembolism (VTE)**

VTE occurs in 3-5% of trauma patient. Known risk factors are old age, blood transfusion, femoral / tibial fracture, spinal cord injury, head injury, major operation, complex lower-extremity fracture, venous injury, complete paraplegia (vs tetraplegia), and multiple comorbidities. For risk stratification of VTE in trauma patients, two models exist; Trauma Embolic Scoring System (TESS) and the Risk Assessment Profile (RAP). We will discuss the validity and limitation of using these models in Korean trauma patients, and also go over the available guidelines on the prevention and treatment of VTE in trauma patients (2002 EAST guideline, 2012 9th ACCP guideline, 2016 10th ACCP guideline).

## Poster Presentation

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EP-001

## A Case of Atlanto-occipital Dislocation with Progressive Neurologic Deterioration

Hee-Jin Yang, Seong Bae Park

Borame Medical Center

### Objective

Atlanto-occipital dislocation usually developed after high velocity accident, frequently results in fatal outcome. Here presented one case with relatively stable initial condition with progressive deterioration.

### Methods

A 73-year-old male was brought to emergency department. He was transferred from a pedestrian traffic accident. It was said that he was run over by slowly moving vehicle. Initial GCS was E2M2V2, imaging study revealed atlanto-occipital dislocation.

### Results

Further evaluation including spine MRI was prohibited due to progressive deterioration of the patients. Cardiac arrest developed 2 times at ER and the patient became comatose. Despite the supportive care including hypothermia in intensive care unit, the patient expired 3 days after trauma.

### Conclusion

It might be speculated that the relatively low speed injury caused the dislocation and resulting compression might compromise the function of the brainstem. Possible vascular compromise of progressive brainstem swelling after trauma might precipitate the deterioration of the condition of the patient, although supportive imaging data was not available.

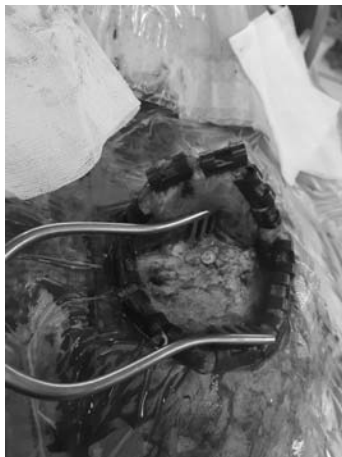
## A Case of Penetrating Brain Injury by Nail Gun

Jin bong Ye, Seungman Ha

Chungbuk National University Hospital

Penetrating head injury by an nail gun is rare cases. We report a case of 36-year-old man who presented with an nail lodged at occipital lobe & parietal lobe through occipital bone (Figure 1, 2). He was alert and neurologically intact but visual disturbance. Brain CT showed no intracerebral hemorrhage. The nail was entered occipital lobe close by saggital sinus. We removed the nail with craniotomy since the entrance of nail was closed to saggital sinus. Saggital sinus injury was not identified and The patient recovered well without any significant complications. Visual disturbance was followed up at out patient department. The verification of the type of the foreign objects, and an identification of adjacent cerebral vascular structure seem to be important in the management to remove the foreign body without further vascular injury or uncontrolled intracranial hemorrhage.

**Keywords:** Nail gun, Penetrating head injury



EP-003

## A Case Spinal Epidural Hematoma after Minor Indirect Trauma - Impact of NOAC

Hee Jin Yang, Seong Bae Park

Borame Medical Center

### Objective

Spinal epidural hematoma is not a frequent entity. It requires urgent surgical evacuation in cases with neurologic symptoms. Here presented a case of spinal epidural hematoma developed at previous operation site after minor indirect trauma.

### Methods

A 72-year-old male patient visited our hospital for progressive gait disturbance. Spine imaging revealed spondylotic myelopathy due to cervical spinal stenosis. He was taking NOAC due to previous history of cerebral infarction. Cervical laminoplasty was done uneventfully and the patient was discharged 7 days after operation with improved symptom. He visited ER 2 days after discharge due to severe neck pain and gait disturbance. He slipped down at the day of visit, blunt trauma to buttock area. There was no direct trauma at operation site. Pain at operation site developed thereafter and progressed. Tense swelling at operation site with subcutaneous ecchymosis was evident. Weakness of lower extremity was also detected.

### Results

Spine MR revealed massive deep hematoma with extension into epidural space. Emergency operation was done to evacuate the hematoma. There was no definite active bleeding focus. Neck pain dramatically resolved after operation and lower extremity improved.

### Conclusion

It was thought that hypocoagulability due to NOAC caused progressive bleeding at previous operation site after minor indirect trauma. This case shows impact of NOAC on development of hematoma at previous OP site even after minor trauma.

## Aberrant Left Internal Iliac Artery Originating from the Aortic Bifurcation

Chan Yong Park, Sora Ahn, Mi Kyung Lee, Sang Hyun Seo, Sung Nam Moon, Seong Keun Moon

Wonkwang University Hospital

Internal iliac artery is mostly originates from common iliac artery. We report a 73-year-old female with aberrant left internal iliac artery directly originating from the aortic bifurcation site. Both common iliac arteries were normally bifurcated from the aorta.

She presented to the emergency department via other hospital due to pelvic fracture. Local abdomen CT showed pelvic fracture with contrast leakage. Angiography showed both normal common iliac arteries and aberrant left internal iliac artery originating from aortic bifurcation. This was also observed in local abdomen CT.

Aberrant internal iliac artery originating from aortic bifurcation is an extremely rare vascular variation. Radiologic intervention for trauma patients often requires rapid progression. The possibility of various vascular abnormalities should be considered. Also, it is very important to carefully review the CT image before the procedure.

## Accidental Finding of *Ascaris Lumbricoides* during Abdominal Penetrating Trauma Surgery: A Case Report

Hojun Lee, Cook-Jong Lee

Ajou University

### Introduction

*Ascaris lumbricoides* is no longer common in South Korea due to the public health system. However, *Ascaris lumbricoides* is still the most common soil-transmitted helminth worldwide. Since it is recently very rare for surgeons in South Korea to encounter *Ascaris lumbricoides* accidentally, we describe how it is presented from a country with low prevalence of parasite infection and discuss possible challenges thru this case report.

### Case Report

23 year old male, a North Korean defector, was shot by the North Korean border guards. Upon his arrival, his vital sign was unstable. Bullet entrance wound was on his buttock. There was no exit wound of the bullet, but the bullet was located within the abdominal muscle layers on the left upper quadrant of his abdomen. There were multiple penetrations of small intestine shown during the operation (Figure 1). Thru the perforation sites, living worms are wriggling out of each sites and the worms were removed one at a time by hands and forceps (Figure 2).

### Discussion

There are only few case reports of accidental findings of *Ascaris* during emergency abdominal bowel surgery. In fact, most trauma surgeons in South Korea are young and most of them never experienced such accidental findings so there is couple of questions arising from this issue; should we have to remove all the worms as much as possible? Or do remnant worms would eat up the suture materials such as silk and cause breakdown of anastomosis sites? Most effective medication for eradication of *Ascaris lumbricoides* is oral tablets, Albendazole. Due to the bowel surgery, we could not give him the pill right away. We tried to give him in forms of powder thru the Levin tube on POD #4 but it did not pass thru the pylorus. Stool exam on POD #6 was positive for the *Ascaris lumbricoides*. On POD #6, the medication was effectively administered and stool exam on POD #10 turned out to be negative. In conclusion, he was discharged on POD #37 without bowel complications such as anastomosis leak in this case. There is no intravenous medication for this round worm yet, it is still recommended that remove round worms near perforation sites as much as possible or use staplers instead of sutures because possible prolonged postoperative ileus cause the delayed administration of the medication.



## Anterior Cervical Osteophyte (C1-C2) and Dysphagia a Case Report

Ralph Dennis Vicente, John Kenneth Rogelio

Armed Forces of The Philippines Victoriano Luna Medical Center

### Objective

To present a rare case of anterior cervical osteophytes c1-c2 and dysphagia

To present osteophytes secondary to trauma

To discuss management for the case presented and cervical osteophytes

### Methods

We are presented in this case a 29 year old military personnel who has a recurrent oropharyngeal mass of the patient. His condition may be attributed with chronic or repeated trauma secondary to repeated biopsy and osteophytic formation. Bony outgrowths from cervical vertebrae are commonly seen in the elderly, and they are usually asymptomatic. These osteophytes may come from cervical spondylosis, or they may be due to primary musculo-skeletal disorders, such as diffuse idiopathic skeletal hyperostosis (DISH). Bony outgrowths may also result less frequently after neck trauma or cervical spine surgery. An article by Chung and Wo mentioned Bony outgrowths from cervical vertebrae are commonly seen in the elderly, and they are usually asymptomatic. These may be osteophytes arising from cervical spondylosis, or they may be due to primary musculo-skeletal disorders, such as diffuse idiopathic skeletal hyperostosis.

### Conclusion

Cervical anterior osteophytes is uncommon in the younger aged group and they are infrequently diagnosed. Dysphagia is typically the presenting symptom. Mechanical obstructions such as anterior cervical osteophytes should be considered as a differential diagnosis for patients presenting with dysphagia or aspiration. We need to make a thorough history and physical examination for patients with dysphagia, Use the different modalities to diagnose this condition and be guided for appropriate treatment.

EP-007

## Bilateral Craniectomies in Acute Both Subdural Hematoma and Endoscopic Removal of Epidural Hematoma due to Injury of Superior Sagittal Sinus

Jongtae Park, Eunsung Park

Wonkwang University Hospital

### Objective

Hemostasis was the major technical problem during the early years of neurosurgical development. Delayed EDH occurred because open or poorly secured dural blood vessels - particularly those arteries not identifiable at the time of closure because they were not bleeding - began to bleed several hours after surgery as a result of improved perfusion (normal systemic blood pressure).

We would like to recommend the prophylactic use of dural tenting sutures to prevent massive bleeding from sinus laceration.

### Methods

A 62 years old male visited ER with drowsy mentality and rapidly deteriorated to stuporous mental status. Initial CT showed left SDH and suspicious of SSS injury and followed up CT showed more enlarged left SDH and multiple contusion. And then we did craniectomies and removal of SDH both side.

### Results

We performed bilateral cranioplasty at 10 months after attack. We can see relative good brain condition from CT.

### Conclusion

Dural tenting sutures continue to have an important role in neurosurgery. We can have a satisfactory result from bilateral acute SDH with laceration of SSS.

Various names have been applied to the sutures used to attach the dura tightly to cranial bone: tenting sutures, dural periosteal sutures, tacking sutures, tack-up sutures, stay sutures, suspension sutures, and sleeper sutures. The last term "Sleeper sutures help the neurosurgeon sleep at night," simultaneously reflecting and perpetuating the notion that this prophylactic subroutine reliably prevents postoperative EDH and, therefore, must be included in every craniotomy.

## **Cervical Epidural Hematoma that Induced Sudden Paraparesis after a Cervical Spine Massage: A Case Report**

Je Il Ryu, Jin Hwan Cheong, Jae Min Kim, Ki Chul Park, Jong Hoon Song

Hanyang University Guri Hospital

### **Objective**

Most people understand spinal manipulation therapy to be a safe procedure, and in many cases treatment is provided without a diagnosis if there is musculoskeletal pain. Cervical epidural hematoma occurs in extremely rare cases after cervical manipulation therapy. This study reports a case of epidural hematoma that occurred in the anterior spinal cord after cervical massage.

### **Case Description**

A 38-year-old male patient was admitted to the emergency room for sudden weakness in the lower extremity after receiving a cervical spine massage. No fracture was found using cervical X-ray, and there were no particular findings on performing brain computed tomography (CT) or diffusion magnetic resonance imaging (MRI). However, using cervical MRI, an acute epidural hematoma was observed in the anterior spinal cord from the C6 and C7 vertebrae to the T1 vertebra, compressing the spinal cord. There were no other fractures or ligament injury. No surgical treatment was required as the patient showed spontaneous improvements in muscle strength and was discharged after just 1 week, after observation of the improvement in his symptoms.

### **Conclusion**

Although cervical epidural hematoma after cervical manipulation therapy is extremely rare, if suspected, a thorough examination must be performed in order to reduce the chances of serious neurological sequelae.

EP-009

## Clinical Outcomes of Mini Plate Augmented Fixation in Complex Patellar Fracture

Ajit Kumar Kar, Jong-Keon Oh, Jae-Woo Cho, Ki-Ho Moon, Jin-Kak Kim, Beom-Soo Kim, Do-Hyun Yeo

Korea University Guro Hospital

### Objective

The purposes of the study were 1) to introduce various application of mini-plate augmented fixation and 2) to evaluate its clinical outcomes for complex patellar fracture.

### Methods

This was a retrospective review of a prospectively collected data at an urban university medical center. Two orthopaedic trauma surgeons used single mini-plate augmented fixation technique managing complex patellar fracture from January 2014 to January 2016. Comminuted articular fracture was managed by tension band wiring augmented with anterior cortical plating. Comminuted inferior pole fracture was managed by separate vertical wiring augmented with rim plating. Non-comminuted transverse fractures that were amenable to standard K-wire TBW fixation constructs were excluded from the study. Skeletally immature patients and the patients who have bipartite or tripartite patella were excluded. The patient was followed at regular intervals for a minimum of 12 months. The primary endpoint was radiologic union. A secondary endpoint was complications related operation. Functional outcomes including range of motion were also evaluated.

### Results

Total 33 patients were followed for an average of 14 months (range, 12-27 months). Average patient age was 56.6 years (range, 28-84 years), and 18 male and 15 female.

Twenty five patients were OTA 34 C fractures. 8 patients were OTA 34 A1 fractures (Comminuted: 6). Tension band wiring with augmented anterior cortical plating was performed in 25 patients. Separate vertical wiring with rim plating was performed in 8 patients.

The primary union rate was 94% (31/33 pts). Mean time to union was 5.2 months. Two patients were required additional surgery which were resulted from acute postoperative infection and irritation of loosened screws.

### Conclusion

Mini plate augmented tension band wiring or separate vertical wiring could be a versatile and useful technique for complex patellar fracture fixation.

## Clinical Results of Rim Plating Technique Using 2.7 mm VA LCP in Tibial Plateau Fracture

Norhaslinda Binti, Beom-Soo Kim, Do-Hyun Yeo, Ki-Ho Moon, Jin-Kak Kim, Jae-Woo Cho, Jong-Keon Oh

Korea University Guro Hospital

### Objective

The purpose of this study is to introduce rim plating technique and report its clinical result in complex tibial plateau fractures.

### Methods

Between January 2013 and December 2015, Twenty three patients were treated with this technique. There were 9 female patients and 14 male patients with a mean age of 55 years (range 26-81 years).

Fracture was classified according to AO-OTA classification

Anterolateral approach for anterolateral rim or modified anterolateral approach for posterolateral fragment were performed. We contoured 2.7 variable angle LCP plate (Depuy Synthes, USA) according to the shape of the rim of lateral plateau. Plateau fracture was stabilized 2.7 mm rim plating alone or augmentation of metaphyseal buttressing plating (2.7mm or 3.5mm) or additional screws. To verify effectiveness and safety of this technique, we evaluated intraoperative details, follow up complications, union rate and functional score.

### Results

Rim plating was performed along the lateral plateau rim (Anterolateral rim : 12 cases, Lateral rim : 3 cases and Posterolateral rim : 8 cases). Fixation construct were 8 cases of rim plating alone, 5 cases of rim plating plus additional screws, 4 cases of rim plating plus 2.7mm buttress plating and 6 cases of rim plating plus 3.5 anterolateral buttress plating.

The articular reduction was evaluated by postoperative CT scan (Poor (>2 mm): 1 case, Imperfect (<2 mm): 7 cases and anatomical : 15 cases). There was no reduction loss during follow up. Bony union was achieved in all cases approximately 3 months after surgery (range 2-4.5 months). The patient reported functional outcomes using the Lysholm score (average 88.7, range 72-95).

### Conclusion

Rim plating using the 2.7 mm VA LCP can be an effective alternatives or augment which could be applied to complex tibial plateau fracture.

## Comparison of Outcomes before and after Establishing a Regional Trauma Center and Following a Protocol to Treat Blunt Splenic Injury in South Korea: A Retrospective Study

Min A Lee, Byungchul Yu, Jungnam Lee, Kang Kook Choi,  
Jae Jeong Park, Youngeun Park, Ahram Han, Jihun Gwak, Gil Jae Lee

Gachon University Gil Medical Center

### Objective

This study aimed to investigate the changes in management and clinical outcomes of splenic injury by introducing a protocol for splenic injury at a newly established regional trauma center.

### Methods

From January 2005 to December 2016, we reviewed the outcomes of all 257 patients who sustained blunt trauma to the spleen at the first regional trauma center in South Korea. This 11-year period was divided into two intervals, before January 1, 2014 (period I, n=189 patients) and after January 1, 2014 (period II, n=68 patients) when the trauma center was established and a formal management protocol was followed for patients blunt traumatic splenic injuries. Splenic injuries were graded according to the organ injury scale of the American Association of Surgery for Trauma.

### Results

The proportion of emergency operations performed for patients with more serious (grade 3-5) splenic injuries was lower in period II than in period I (29% vs. 22%,  $p<0.001$ ) whereas the rate of angioembolization was higher (89% vs. 39.0%,  $p<0.001$ ). The time to intervention, whether emergency operation or angioembolization, was shorter in period II than in period I (312.8 min vs. 129 min,  $p=0.001$ ). A greater proportion of patients was managed non-operatively in period II (78% vs. 71%), and the non-operative management success rate was higher in period II than it was in period I (100% vs. 83%;  $p=0.014$ ). Similarly, the splenic salvage rate was higher in period II (78% vs. 59%,  $p=0.03$ ).

### Conclusion

After establishing a regional trauma center and introducing a protocol for the management of blunt splenic injuries, the rates of non-operative management and splenic salvage improved significantly. The reasons for this may be multifactorial, being related to the early involvement of a trauma surgeon, expansion of angiographic facilities and resources, and the introduction and application of protocol for managing blunt splenic injury.

## **Comparison of Sagittal Values between Lateral Decubitus Plain Radiography and Supine Computed Tomography in Thoracolumbar Fractures - A Greater Degree of Kyphosis is Observed in Plain Radiography than CT**

Seungmyung Choi

Chungbuk National University, Cheongju, Korea

### **Objective**

Radiologic parameters are important factors for planning the treatment for thoracolumbar fracture. However, we noted that measurements of the degree of kyphosis by lateral decubitus plain radiography were greater than supine CT. The cause of this discrepancy is unclear.

### **Methods**

We retrospectively reviewed the plain radiographs and CT scans of 90 patients with thoracolumbar fractures (fracture group). We measured the segmental sagittal angle (SSA) on lateral decubitus plain radiographs and in the median sagittal plane on CT scans obtained in the supine position. The method agreement (plain radiography versus CT) was determined by utilizing Bland-Altman plots. After establishing the method disagreement in the fracture group, the factors that contributed to the difference in the SSA between plain radiography and CT, as well as their threshold values, were determined.

### **Results**

On Bland-Altman plots for the fracture group, the mean difference was  $4.53^\circ$  (95% confidence interval [CI]:  $-4.87$  to  $13.93^\circ$ ). For the normal group, the mean difference was  $-0.64^\circ$  (95% CI:  $-5.87$  to  $4.58^\circ$ ). On univariate analysis, male sex, thoracolumbar level, and SSA(X) were significant factors associated with  $\Delta$ SSA ( $P=0.03$ ,  $0.002$ , and  $0.000$ , respectively). Multivariable regression analysis showed that SSA(X) was the only significant factor. Receiver operating characteristic curve analysis indicated that the optimal threshold of SSA(X) was  $17^\circ$  with a sensitivity of 78% and a specificity of 75% (area under curve: 0.752).

### **Conclusion**

The mean SSA determined on lateral decubitus plain radiographs indicated significantly more kyphosis than that determined on CT images obtained in supine position. When the SSA on plain radiography is more than  $17^\circ$ , there might be a significant discrepancy between the two imaging modalities. This discrepancy seems to be mainly attributable to the difference in patient positioning (lateral decubitus position for plain radiography vs. supine position for CT imaging).

## Comparisons of CT Perfusion Parameters of Blunt Liver Trauma between Groups Treated with Angioembolization and Conservative Management

Yon-Cheong Wong, Li-Jen Wang, Cheng-Hsien Wu, Huan-Wu Chen

Chang Gung Memorial Hospital at Linkou

### Objective

This study is to evaluate if angioembolization for blunt liver traumatic hemorrhage would cause liver perfusion defect and trauma-related complications.

### Methods

We performed liver perfusion CT for 19 patients of major liver injury (12 men, 7 women; mean age  $34.5 \pm 13.6$  years) who met our inclusion criteria. Charts were reviewed for injuries grades, management choice and complications. The CT perfusion parameters were compared and a 2-tail p-value  $< 0.05$  was considered significant.

### Results

Patients did not differ in age, sex and liver injury grades. The whole liver hepatic arterial perfusion (HAP;  $107.5 \pm 85.8$  vs.  $136.7 \pm 111.5$  mL/min/100 mL,  $p=0.027$ ) and hepatic portal perfusion (HPP;  $90.8 \pm 78.7$  vs.  $111.8 \pm 112.0$  mL/min/100 mL,  $p=0.018$ ) of trauma parenchyma were significantly lower than non-trauma parenchyma. However, the arterial perfusion fraction did not differ (AFP;  $57.7 \pm 19.7\%$  vs.  $55.1 \pm 22.6\%$ ,  $p=0.398$ ). Of 19 patients, 11 underwent angioembolization, 8 underwent conservative management. Four required pigtail catheter drainage, 15 did not. Differences of HAP, HPP, APF between groups treated with angioembolization and conservative management were not statistically significant. Association of catheter-drainage with treatments or CT perfusion parameters was not significant.

### Conclusion

Whole liver HAP and HPP were lower in trauma parenchyma than non-trauma parenchyma. Angioembolization was neither associated with perfusion defect nor the need for pigtail catheter drainage. A larger sample size is necessary to validate these observations.

## Conservative Treatment of Acute Traumatic Left Renal Vein Occlusion: Implication of Left Gonadal Vein

Chaeyoon Lee, Jihoon Jang, Jinyoung Park, Kyoung Hoon Lim

Kyungpook National University Hospital

### Objective

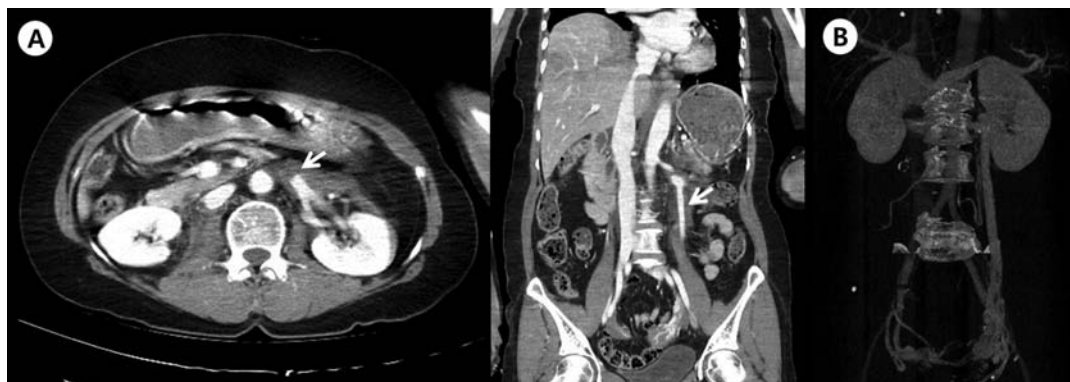
Rare cases of trauma-induced renal vein thrombosis have been reported. Both kidneys have limited capsular and peripelvic vein collaterals, but only the left renal vein has potential collateral pathways through the gonadal, inferior adrenal, and lumbar veins. Herein, we present the successful conservative treatment of acute traumatic left renal vein occlusion.

### Case Presentation

A 56-old-woman with no specific medical history was transferred to our trauma center after a pedestrian accident. She presented with alert mentality, mild dyspnea, chest pain, and pelvic pain. Her vital sign was stable and there were not evidences of active bleeding. The evaluation of trauma series revealed left multiple rib fractures, left clavicular fracture, right diaphragmatic rupture, left renal vein occlusion, and pelvic ramus fracture. Abdominal Computed Tomography (CT) with contrast showed that no delineation of left proximal renal vein with adjacent hematoma around left renal artery, but left renal vein was being drained through left ovarian vein therefore, left kidney was not congested (Fig. 1A). We have decided to perform conservative treatment of the left renal vein occlusion because of collateral pathway into the ovarian vein, and we performed laparoscopic repair of right diaphragmatic rupture. Post-operative anticoagulation therapy was not available because she had a bleeding risk of retroperitoneal hematoma. On 3 month follow up, abdominal CT with contrast enhancement showed that the left renal venous drainage to the ovarian vein was successfully maintained (Fig. 1B).

### Conclusion

Acute right renal vein occlusion causes venous infarction, but acute left renal vein occlusion close to the inferior vena cava produces temporary venous hypertension and congestion followed by complete or nearly complete return of function as collateral veins enlarge. If gonadal vein is patent, left renal vein occlusion could be treated conservatively.



## Decompression with “Lateral Pediclectomy” and Circumferential Reconstruction for Unstable Thoracolumbar Burst Fractures: Surgical Techniques and Results in 18 Patients

Woo-Keun Kwon, Jong-Keon Oh, Joo Han Kim

Korea University Guro Hospital, Korea University College of Medicine

There are still no generally agreed consensus known as the golden standard for surgical treatment of thoracolumbar (T-L) fractures. However, the main issues have been proper neural decompression and rigid stabilization with minimal sacrifice of other stable segments.

We introduce retro-pleural/peritoneal “lateral pediclectomy” for the decompression of the canal encroached fragment and reconstruction using expandable titanium cage, lateral fixation devices and percutaneous pedicle screw at single stage for substantial stabilization and reducing fusion segment.

18 patients (M:F=11:7; mean age,  $54.63 \pm 23.49$  years) who suffered from single unstable, compressive T-L fracture were treated using this technique by a single surgeon between January 2014 and December 2016 (T12: 9 cases, L1: 7 cases, L2: 2 cases). These cases were reviewed retrospectively in terms of radiologic (CT scan and X-ray), clinical outcomes and complications. The results were compared with another group of T-L fractures treated by posterior only surgery.

There was no radiologic complication implying mal-union or mal-alignment on the postoperative 6 months CT scan. There was also no neurologic deterioration and infection at the same period. 2 patients (11.%) of iatrogenic injury and 1 patient of trauma related injury of dura were secured without delayed complications. 3 patients (16.7%) of transient weakness in left hip adduction after immediate post-operation were observed and recovered within 2 weeks in all the patients. 6 patients (33.3%) complained of dysesthesia and/or hypoesthesia on wound site.

The present technique suggests “lateral pediclectomy” as a distinct anatomic landmark and surgical tactics to access and remove bony fragment effectively and safely. This provides a more straightforward assess to the burst fragment and helps the surgeon to make better intra-operative decompression strategies. Moreover, this circumferential instrumentation with anterior support and fusion revealed better restoration of the T-L spine alignment compared to posterior only surgery, with acceptable complications rates.

EP-016

## **Delayed Cerebral Air Embolism with Patent Subcutaneous Tract Following Central Venous Catheter Removal**

Seok Jeong Yang, Sung Kyun Park

Ulsan University Hospital

**Withdrawn**

## Effect of Hypoxia and Medicines on the Immune Cells

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<sup>1</sup>Nuwacell, <sup>2</sup>Korea University Guro Hospital

### Objective

The patients due to severe trauma may experience bleeding, difficulty breathing, and further that the experience can fall into hypovolemic shock. In the treatment of shock patients, airway maintenance and oxygen supply are known to be of paramount importance. Therefore, this aim of study was to investigate the effects of oxygen supply and variable medication in hypoxic condition. We conducted an experiment to determine the effect of oxygen and variable medication on iNOS, macrophage migration inhibitory factor (MIF) as an inflammatory cytokine of macrophage, in T cell viability (MTT), IL-2, IL-8 as an immune marker of T cells proliferation and T cells in hyperinflammatory condition by using coculture.

### Methods

The experiments were performed with THP-1 derived macrophage and Jurkat cells. First, macrophage cells put through normoxic state, hypoxic state, oxygen supply and variable medication, and measured the iNOS, MIF by western blots. Second, Jurkat cells also were incubated in the same way as in the first instance, and measured MTT, IL-2 and IL-8. Third, in co-culture, after Jurkat cells under hyperinflammatory macrophage cells were incubated through hypoxic state, oxygen supply and variable medication, and measured MTT, IL-2.

### Results

iNOS and MIF increased in hypoxic state in macrophage cells. Pentoxifylline (PTX) under oxygen supply condition restored iNOS in stimulated macrophage. MTT and IL-2 decreased in hypoxic condition, however PTX restored T cell viability, regardless of oxygen supply. IL-8, MIF increased in hypoxic condition, however PTX and steroid restored IL-8, MIF. In coculture condition, oxygen supply and pentoxifylline more increased MTT, IL-2 than PTX in hypoxic state.

### Conclusion

Hypoxia decreased T cell viability. iNOS, MIF and IL-8 increased in hypoxic state rather than normoxic state. However, PTX restored T cell viability, IL-2 in oxygen supply condition than the hypoxic state.

## Experience of Penetrating Gunshot Wound on Head in Korea: Case Report

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

Chungbuk National University Hospital

Craniocerebral gunshot injuries (CGIs) are extremely seldom happened in Korea because possession of individual firearm is illegal. So CGIs are rarely encountered by Korean neurosurgeons or Korean trauma surgeons, though in other developing countries or United States of America their cases are indefatigably increasing. Management goal should focus on early aggressive, vigorous resuscitation. The treatments consist of immediate life salvage through correction of coagulopathy, intracranial decompression, prevention of infection and preservation of nervous tissue. There have been few studies involving penetrating CGIs in Korea. Here we present a case of penetrating gunshot wound in Korea. We present a 58-year-old man who was unintentionally shot by his colleague with a shotgun. The patient underwent computer tomography (CT) for assessment of intracranial injury. The bullet passed through the left parietal bone and right lateral ventricle and exited through the posterior auricular right temporal bone. After CT scan, he arrested and the cardiopulmonary resuscitation was conducted immediately. But we were unable to resuscitate him. This case report underscores the importance of the initial clinical exam and CT studies along with adequate resuscitation to make the appropriate management decision. Physicians should be familiar with the various injury patterns and imaging findings which are poor prognostic indicators.

EP-019

## Fatal Post-operative Epilepticus after Burr-Hole Drainage for Chronic Subdural Hematoma in Elderly Patient

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### Objective

Incidence of post-operative seizure after burr-hole trephination (BHT) for chronic subdural hematoma (C-SDH) is known to be very low. The effect of the prophylactic antiepileptic drug in reducing the development of new seizure after surgery is still unclear.

### Methods

Here, we present a case of fatal status epilepticus with progressive respiratory complication following early discontinuation of prophylactic antiepileptic drug in an 84-year-old man who had undergone bilateral BHT and closed-system drainage for bilateral C-SDH.

### Results

In our case, the patient was 84 years old and underwent bilateral BHT for bilateral C-SDH. After early discontinuation of the antiepileptic drug, he died with fatal status epilepticus and respiratory complications. Although the efficacy of the prophylactic antiepileptic drugs in BHT for C-SDH has been controversial, the development of status epilepticus postoperatively seems to be strongly associated with an increased mortality rate in elderly patients.

### Conclusion

The prophylactic antiepileptic drugs should be administrated in elderly patients who undergo surgery for C-SDH, until a definitive clinical treatment guideline is suggested. A larger prospective research is warranted in the future to further clarify the efficacy of this antiepileptic prophylaxis and avoid the fatal complication.

## Interventional Urethral Realignment as a Radical Treatment in Posterior Urethral Disruption Accompanied by Complex Pelvic Fracture

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 Kim<sup>1</sup>, Chan Yong Park<sup>2</sup>

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

### Objective

Unlike anterior urethral injury, posterior urethral rupture accompanied by complex pelvic fracture would have the distance between the ruptured urethra becoming wider due to pelvic hematoma, and thus, interventional urethral realignment would be expected to face similar difficulties as surgical urethral realignment. To evaluate the clinical efficacy of interventional urethral realignment as a radical treatment in patients with posterior urethral disruption accompanied by complex pelvic fracture.

### Methods

This retrospective study included 8 patients with traumatic posterior urethral disruptions who were treated with interventional urethral realignment between November 2016 and September 2017. All 8 patients were men with the mean age of 50.5 years. Reviewed results included patient demographics, technical success rate of interventional urethral realignment, fluoroscopic findings, manner of procedure, required procedure time, duration of urethral catheterization, and procedure-related complications.

### Results

Interventional urethral realignment was technically successful in 6 of 8 patients (75.0%). The majority of patients were young male involved in motor vehicle crashes. In 5 patients, the catheter previously placed by retrograde urethrography was used as a landmark, and the antegrade guidewire was successfully navigated through the free space of urethra separated further by rupturing and exited through the outer urethral orifice by finding the true lumen of the distal urethra. In one patient, the rendezvous technique with a snare catheter in the free space was used. The mean procedure time was 51.2 minutes (range, 40-65 min). The mean duration of urethral catheterization after interventional urethral realignment was 63 days (range, 48-94 d). There were no immediate complications related to procedure, although all patients developed symptomatic urethral stenosis after urethral realignment.

### Conclusion

Interventional urethral realignment is a safe and minimally invasive procedure that can be performed in a patient with posterior urethral rupture accompanied by complex pelvic fracture.

EP-021

## Isolated Pancreatic Transection due to Motorcycle Accident with Endoscopic Treatment: A Case Report

Chan Ik Park, Sung Jin Park, Jae Hun Kim, Dong Hoon Baek

Pusan National University Hospital

### Context

Isolated pancreatic transection due to blunt trauma is a rare occurrence and usually requires surgical treatment. Nonoperative treatment for pancreatic transection remains controversial because of its associated complications. However, nonoperative treatment has been increasingly used as a treatment option with promising results in recent years.

### Case Report

The patient presented with suspected pancreatic injury caused by motorcycle accident. Computed tomography findings revealed an isolated pancreatic neck transection with a small amount of fluid collection. He was hemodynamically stable without signs of peritoneal irritation. Endoscopic retrograde pancreatography and stent insertion were performed. The patient had no significant complications and was discharged on day 18. The stent was removed on day 103 and the patient has shown good recovery.

### Conclusion

For isolated pancreatic transection, endoscopic intervention can be considered as an alternative with good outcome in selected patients.

## Operation Experience of Regional Trauma Center in Gangwon Province

Kwangmin Kim, Youngwan Kim, Jiyoung Jang

Wonju medical college, Yonsei university

### Objective

석해군 선장의 치료와 북한 병사 수술등의 사건 등으로 인해 우리나라내의 외상센터의 관심이 줄어들지 않고 있다. 본 연구에서는 그 동안의 외상센터 운영의 경험을 바탕으로 강원권역에서의 외상센터가 외상 환자의 치료에 얼마나 기여했는가를 조사해보고자 하였다.

### Methods

2014년 1월 부터 2016년 12월까지 원주세브란스 기독병원 강원 권역 외상 센터에 내원한 외상 환자를 대상으로 연구를 진행하였다. 외상센터 개소전(2014년)과 개소후(2015-2016년) 내원 한 외상 환자들의 변수들을 비교 분석하였다.

### Results

2014년 내원한 총 환자수는 2108명 ISS 15점 이상인 환자는 365명이었고, 2015년 총 환자수는 2370명, ISS 15점 이상인 환자는 435명이었다. 2016년 총 환자수는 2438명, ISS 15점 이상인 환자는 469명이었다. 외상센터 개소전에 내원한 환자(ISS>15)와 개소후의 환자(ISS>15)의 환자군의 나이, 성별, ISS, RTS 차이는 없었다. 개소 후 치료 결정은 개소전보다 통계학적으로 유의하게 빨라졌음을 확인 할 수 있었다. 사망률과 재원 기간의 차이는 없었다.

### Conclusion

개소전과 비교하여 개소후 내원 환자는 증가하였으며, 사망률과, 재원기간의 차이는 없었으나, 환자 치료 결정이 빨라져 환자 치료의 질은 증가 되었음을 확인 할 수 있었다.

## Outcomes Following Treatment of Geriatric Distal Femur Fractures

Ki Chul Park, Jong Hoon Song, Jin Hwan Cheong, Je Il Ryu

Hanyang University Guri Hospital

### Objective

In elderly patients, distal femoral fractures are usually occurred by low energy trauma. Surgical treatment is difficult because osteoporosis is often associated. Geriatric distal femur fractures have a high morbidity and mortality. In this study, we analyzed the clinical and radiological results following treatment of geriatric distal femur fractures.

### Methods

We retrospectively reviewed 46 patients over age 60 who sustained a low-energy femur fractures (AO/OTA 33A) treated with ORIF using locked plating from January 2008 through January 2016. Primary outcomes included nonunion, reoperation to promote union and death. Charlson Comorbidity Index (CCI) was calculated based on comorbidities documented in the medical record. Length of hospital stay and CCI were analyzed to find the relation with mortality. In addition, periprosthetic fracture group and non-periprosthetic fracture group were compared for analysis.

### Results

Nonunion was observed in 8 patients (17.4%) and all achieved bone union after re-operation. The overall mortality rate was 6.5% and complication rate was 21.7%. There were twenty five periprosthetic fractures (P group) and twenty one non-periprosthetic fractures (N group). Comparison between these two groups showed no significant differences in union time; periprosthetic fracture (18.1 weeks) and non-periprosthetic fractures (18.79 weeks). Nonunion and complications between the two groups were not statistically different. However, the mortality rate was different between the two groups (P group; 0, N group; 3,  $p=0.026$ ).

### Conclusion

Geriatric distal femur fractures have a high incidence of complications including nonunion, delayed union and death. Further research on risk factors for complications and mortality is needed.

## Outcomes of Emergency Department Laparotomy in Non-responder after Resuscitation: Early Experience in a Single Center

Chan Ik Park, Jae Hun Kim, Gil Hwan Kim, Chan Kyu Lee, Kwang Hee Yeo,  
Seon Uoo Choi, Sung Jin Park, Seon Hee Kim, Ho Hyun Kim, Hyun Min Cho

Pusan National University Hospital

### Objective

Outcomes of patients with bleeding depend on how rapid bleeding stop. Emergency department laparotomy is considered one of ways to reduce intra-abdominal bleeding. Here we evaluated the outcomes of emergency department laparotomy through the early experience of a single trauma center.

### Methods

We reviewed medical records and data of patients who were non-responder after resuscitation and underwent emergency department laparotomy between January 2016 and December 2017.

### Results

Twelve patients underwent emergency department laparotomy. Ten patients had sustained blunt trauma, and two were victims of abdominal stab wounds. Injuries to the small bowel, spleen, and liver were most common. One patient could not reach the operating room. Three of 12 were survived. One of three who were survived had severe neurologic sequelae.

### Conclusion

Patients that underwent emergency department laparotomy showed high mortality. However, emergency department laparotomy can be considered as an option to reduce intra-abdominal bleeding for non-responder after resuscitation.

EP-025

## Percutaneous Drainage of Huge Hepatic Subcapsular Hematoma in Chronic Renal Failure after Blunt Abdominal Trauma

Younggoun Jo, Yunchul Park, Wuseong Kang, Jungchul Kim

Chonnam National University Medical School

### Objective

Patients with chronic kidney disease (CKD) display a wide range of derangements in hemostasis. Laparotomy in trauma is a general strategy for the hemostasis, however, this may not be effective in CKD. Therefore, we report a case of huge subcapsular hematoma of the liver which treated a percutaneous drainage and angioembolization.

### Methods

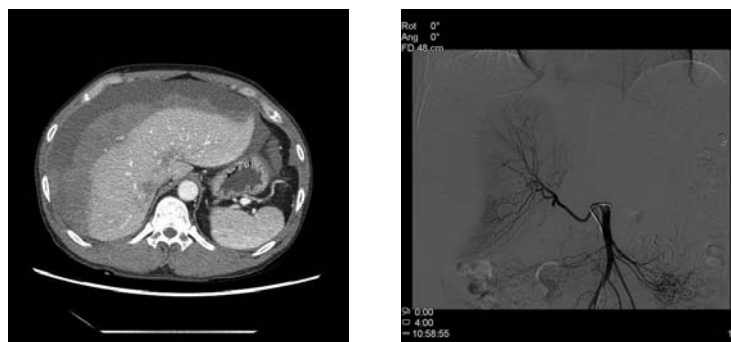
A 37-year old male was transferred to the emergency department after a motor vehicle accident. On arrival, his vital sign was stable, and he presented with abdominal pain. The patient's hemoglobin level was 9.9 g/dL. Chest Computed Tomography (CT) revealed multiple fractures of left ribs. On his abdomen CT scan, liver laceration and large volume subcapsular hematoma of liver involving right and left lobe were detected, and contrast arterial blush was noted in the subcapsular hematoma (Fig. 1). There were no absolute indications for laparotomy like pneumoperitoneum.

### Results

Angiography revealed the huge hepatic hematoma and confirmed arterial bleeding in the periphery of the liver (Fig 2). Gelatin embolization was performed, and no active bleeder further. Even if no further bleeding, the patient presented with abdominal discomfort and dyspnea because of the large size of hematoma. We performed the percutaneous drainage of hematoma at 10 days after the hospital admission. Because of the too large volume of hematoma, even though his drainage duration was somewhat long, he was discharged without any complications.

### Conclusion

After the bleeder control with angioembolization, because of minimal regression of hematoma on his follow up CT, we considered of the laparotomy and laparoscopic approach. However, after the careful consideration of hemostatic derangement in the CKD patient, we decided to continue the percutaneous drainage.



## Post-traumatic Delayed Rupture of Pseudoaneurysm of Spleen

SoRa Ahn, MiKyoung Lee, ChanYong Park

Wonkwang University Hospital

### Objective

Damage to intra-abdominal solid organs such as liver and spleen after traumatic injury often occurs. Delayed pseudoaneurysm of solid organs sometime occurs. We recently experienced rupture of delayed pseudoaneurysm of spleen and report it.

### Methods

A/S; 74/M

mode; in-car TA

C/C; Ant. chest wall pain, Lt. pelvic pain

M/S; stupor

V/S; BP 100/70, PR 91

He was transferred our Trauma Center due to change his mental status alert to stupor.

### Results

We evaluated his whole body. Brain CT revealed no problem in spite of his mental status was stupor. Follow up brain CT was normal, too. There are multiple rib Fx. and pelvic bone Fx.

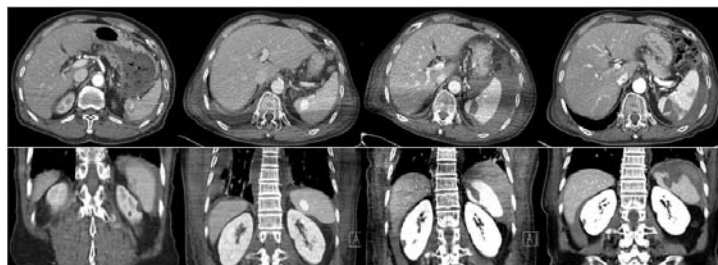
And A-P CT revealed that there was a focal curvilinear hypo-attenuated lesion in spleen with perisplenic hemorrhagic collection suggesting splenic laceration. Vital status was stable and Hb. was not decreased so we decided to do conservative Tx.

There were consolidations on both lungs from the time of admission, they were progressed. So we did Chest CT F/U at POD #6 but, missed the pseudoaneurysm of spleen. Next day Hb. was decrease 11.0 to 7.0. But, vital was stable and no other symptom was detected such as abdominal pain. And after 1 week, we did F/U Chest CT again, There was a hemoperitoneum due to rupture of pseudoaneurysm of spleen. So we did emergency TAE by gelform.

He was discharged with symptom turned around at HD#22.

### Conclusion

In this case, we missed the tiny pseudoaneurysm of spleen. If we had TAE the first CT F/U time, the patient may have recovered faster. Fortunately, after rupture of pseudoaneurysm the patient was discharged without problem. But, it can be very dangerous in other situation. So we never ignore small clue when treating trauma patients cause it can be the seed of misery.



EP-027

## Post-traumatic Pseudoaneurysms of Left Gastric Artery

Yun Su Mun, Dongsub Noh, Jung Joo Hwang, Yong Han Cha

Eulji University Hospital

### Objective

Post-traumatic pseudoaneurysms and delayed rupture of gastric artery are very rare. Prompt diagnosis and management are necessary for mortality is high due to massive intra-abdominal hemorrhage

### Methods & Results

A 79-year-old male complained abdominal pain after slipped down two days ago. CT showed some hemoperitoneum with suspicious contrast leakage and aneurysmal change on left gastric artery. Pseudoaneurysm of left gastric artery was treated by angioembolization. After the angioembolization, he recovered without any special problems.

### Conclusion

Delayed rupture of gastric circulation should always be kept in mind as a possible cause of delayed hemoperitoneum.

## Predictive Factor for Sepsis in Korean Traumatic Patients

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### Objective

Many patients die from sepsis and multiple organ failure, even after primary surgery by trauma. Early diagnosis of sepsis in traumatic patients is important and used in various ways, such as CRP and WBC, but it is incorrect. Recently, procalcitonin (PCT), macrophage migration inhibitory factor (MIF) have emerged as predictive factors. Our study aims to explore the significance of PCT and MIF as a predictor of sepsis in trauma patients.

### Methods

This study was conducted on prospective observational study patients who visited an emergency medical center in a university hospital from March 2014 to February 2016 and were intended for severe trauma patients aged 15 or older. We measured the WBC, the CRP, the lactate, PCT, and MIF with serum taken from the patient's blood within 1 hours. The definition of post traumatic sepsis was defined as being part of SIRS criteria with infections within a week.

### Results

There were 132 patients in the study, 112 men, 20 women, and mean age were  $48.2 \pm 8.8$  years old. The mean injury severity score (ISS) was  $18.1 \pm 7.6$ , the high ISS group ( $ISS \geq 15$ ) had 58 patients and the low ISS group ( $ISS < 15$ ) had 74 patients. The high ISS group had a higher MIF, lactate and PCT than the low ISS group, and showed a correlation between ISS and PCT (0.207), MIF (0.141). There were 38 post-traumatic sepsis patients, 28 of whom were in the high ISS group and 10 from the low ISS group. MIF showed statistically high levels in sepsis patients among severe traumatic patients.

### Conclusion

$ISS > 15$ , MIF, and PCT are possible as predictors of sepsis in severe trauma patients, However, further studies are needed as MIF, PCT is increased depending on the severity of the trauma.

EP-029

## Relationship between Injury Patterns and Severity of Trauma Patients with Meteorological Patterns in Jeju Island

Joongsuck Kim, Oh Sang Kwon, Kyoung Hwan Kim, Min Koo Lee, Hohyoung Lee, Sung Ho Han, Soon-Ho Chon

Cheju Halla General Hospital

### Objective

The purpose of this study is to determine the impacts of weather and date patterns to injury patterns and severity of trauma victims in Jeju Island.

### Methods

We analyzed 3182 patients' data and the corresponding weather and date data over two years' period. Patients' data included parameters such as ISS, TRISS, ICU, emergency operation, and mechanism of injury. The weather and date data included average temperature, humidity, amount of cloud, and wind velocity, day of week, holiday, and season. For statistical analysis, we used logistic regression, Pearson's correlation, chi-square, independent t test, and ANOVA test, depending on the types of variables

### Results

Data analysis revealed more trauma patients were sent to ICU as it got colder, drier, and cloudier (odd ratio: 0.989 95% CI 0.978-1, 0.992 95% CI 0.985-0.99, 1.036 95% CI 1.004-1.06, respectively). There was moderate negative relationship between snow amount and TRISS (coefficient -0.51,  $p=0.018$ ). Compared to other types of trauma, motor vehicle accidents and fall were related with high ISS and low RTS, TRISS (all  $p$  values less than 0.001). Trauma occurring at night time was related with high ISS and low RTS ( $p=0.006$ ,  $p=0.001$ ).

### Conclusion

Injury tend to be more severe when it's colder, drier, cloudier, and darker. This implies adverse weather conditions may result in poor visibility and thus more likelihood of severe injury. High-energy accidents such as fall and motor vehicle accidents were also related with more severe injury. At adverse weather conditions, drivers should be more careful, and trauma centers should be ready for such severely injured.

## Selective Transarterial Embolization of Grade IV Hepatic Injury by Blunt Trauma

Sora Ahn, Un Jong Choi

Wonkwang University Hospital Trauma Center

### Objective

The most injured organs in the abdominal blunt patients are the liver and spleen.

In the past, intraperitoneal hemorrhage due to liver or spleen injury was treated surgically. In recently TAE has been used to stop to bleeding of damaged areas or to help to doing operation. However, when the patient's vital is unstable, it is difficult to choice immediately surgical treatment or intervention.

### Results

A 58-year-old woman visited our emergency center due to in car TA. She appealed to chest pain, both leg pain and Lt. arm pain. At that time, the mental status was alert. The BP was 70/50 and HR was 111 per minute. Her abdomen was severe distended. The CT showed hepatic laceration in liver segment 4 and hematoma with high attenuation inside.

Hemoperitoneum due to active contrast extravasation was also confirmed. Immediately intervention was decided. The celiac angiogram showed multiple punctate pseudoanerysm and active bleeding of Lt. and Rt. hepatic artery. So coil embolization was performed.

In the final angiogram, active bleeding was not observed, but extravasation was confirmed in F/u CT, so TAE was performed again 2 times.

After the procedure, the patient underwent complications such as biloma, hyperbilirubinemia, ARE, and pneumonia, but she recovered gradually enough to eat per oral now (POD # 80).

### Conclusion

When intraperitoneal solid organ was injured obviously and the BP dropped, the surgeon tended to determine emergency operation such as pad packing. However, hemostasis of bleeding of solid organs is often difficult to perform surgically. Recently, TAE has shown good therapeutic effect and is becoming popular.

Of course, in this case, there was an debate that if the Lt.lobectomy was performed after emergency intevention, the patient would have recovered faster. However, in this case it is certain that the intervencion is a Treatment of choice.



## Shattered Spleen in Blunt Trauma: Clinical Results of Trans-arterial Embolization, 4-years Experiences in a Single Regional Trauma Center

Chang Ho Jeon<sup>1</sup>, Chang Won Kim<sup>1</sup>, Rang Lee<sup>1</sup>, Hoon Kwon<sup>1</sup>, Hyun Min Cho<sup>1</sup>, Jae Hun Kim<sup>1</sup>, Chan Yong Park<sup>2</sup>

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

### Objective

Splenic embolization can increase non-operative salvage for hemodynamically unstable blunt splenic trauma patients. However, its efficacy and complications are not clearly defined. A retrospective single center review was performed to delineate the benefits and risks of splenic embolization.

### Methods

A retrospective electronic medical record review of all patients undergoing splenic embolization between April 2013 and March 2017 at a Korean regional trauma care center was performed. Reviewed results included patient demographics, initial and follow-up CT scan results, angiographic findings, embolization techniques, and clinical outcomes including splenic salvage rate and procedure-related complications.

### Results

A total of 94 patients were reviewed. The majority of patients were young male involved in motor vehicle crashes. These patients had high abdominal computed tomographic grades of splenic injury and moderate to severe Injury Severity Scores. Over 90% of splenic injury grades 4 and 5 were successfully managed non-operatively. Patients under 40 years of age had a better clinical course than older patients. Redundant hemoperitoneum and the presence of other organ injury was associated with a high failure rate, even with embolization. The rate of splenic preservation were similar between nonselective temporary and selective embolization groups. Major complications included rebleeding in 10 patients; 6 splenic abscesses, with 4 patients requiring splenectomy.

### Conclusion

Splenic embolization remains a safe and feasible interventional procedure to preserve viable spleen, especially in higher grade lienal injuries. Although complications of splenic embolization exist in some cases, these do not affect outcome. It remains to be proven in prospective or randomized clinical trials that include larger cohorts.

EP-032

## Successful Percutaneous Coronary Intervention (PCI)

Jin Young Lee

Trauma surgery, Chungbuk National University Hospital, Korea

**Withdrawn**

EP-033

## Successful Percutaneous Coronary Intervention in a Case of Right Coronary Artery Dissection after Blunt Chest Trauma

Jin Young Lee, Su Young Yoon

Chungbuk National University Hospital

### Objective

Coronary artery dissection after blunt chest trauma is rare, can lead to myocardial infarction, and be rapidly fatal if not appropriately diagnosed and managed.

### Case Presentation

We had experienced a case of right coronary artery dissection after blunt chest trauma. A 57-year-old female with anterior chest wall pain after traffic accident exhibited ventricular tachycardia and complete atrioventricular block with myocardial infarction. Right coronary artery dissection was detected by coronary angiography and was successfully treated by percutaneous coronary intervention.

### Conclusion

Blunt cardiac injury (BCI) is often difficult to diagnosis and a high index of suspicion is needed. Coronary angiography with revascularization should be performed immediately when coronary artery occlusion or dissection is suspected.

## Surgical Treatment of Mandible Fracture Using Unsintered Hydroxyapatite/Poly L-lactide Composite Fixation System

Eun Soo Park, Sun Jae Lee, Ho Seong Shin, Seung Min Nam, Yong Bae Kim

College of Medicine, Soonchunhyang University

### Objective

The purpose of this study is to confirm the clinical efficacy and usefulness of the unsintered hydroxyapatite/poly L-lactide composite system by clinical application and follow-up of fixation in patients with unilateral lower jaw fracture.

### Methods

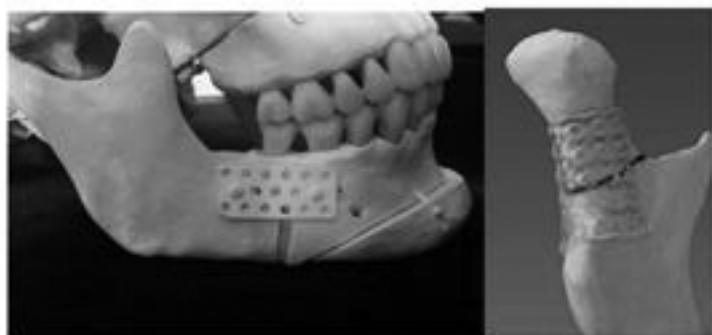
The applicant should be assessed for compliance with the selection criteria and exclusion criteria considered in screening test. Surgery was performed in an intraoral approach in the same manner as before, and reduction and fixation were performed. Follow-up was performed at 1 week, 1 month, 3 months, and 6 months after surgery. Occlusion and mouth opening were checked by physical examination and radiographic finding. We also confirmed the bone approximation status, bony gap change, and bone union status. The results of the study should be compared statistically.

### Results

Ten patients used two Osteotrans absorptive plates for mandibular fracture fixation. There were no complications such as loosening of the plate or screw, foreign body reaction, or chronic pain.

### Conclusion

Osteotrans® was used to induce osteosynthesis without specific complications after mandibular fracture fixation, and there was no need for secondary surgery, because Osteotrans® is absorbent.



EP-035

## Thoracoscopic Approach and Reconstruction to the Mid-thoracic Fractures

Jongtae Park, Jihoon Lee

Wonkwang University Hospital

### Objective

Anterior approaches to the thoracic spine are often required to restore anterior column deficiency after spinal trauma. Conventional open approaches are often associated with significant morbidity, and hence there is a need for a minimally invasive approach to the mid-thoracic fractures. To report the possibility, feasibility and effectiveness of the thoracoscopic approach in the management of mid-thoracic fractures.

### Methods

A 52 years old man with unstable L5 bursting fracture due to falling, we performed posterir and anterior approach and fusion with total L5 spondylectomy. We present a case of a man (52 yrs) who had had 5th thoracic fracture (fraction-rotation injury by traffic accident). He had no neurological deficit(motor & sensory intact) abut complained severe chest pain. We performed thoracoscopic approach and reconstruction to the mid-thoracic fractures.

### Results

After operation, the patient walk without any aid.

### Conclusion

Thoracoscopic spine surgery is applicable to all pts with mid-thoracic fracture.

## Thoracoscopic Transdiaphragmatic Approach to L2 Fractures

Jongtae Park, Eunsung Park

Wonkwang University Hospital

### Objective

To report the possibility, feasibility and effectiveness of the thoracoscopic transdiaphragmatic approach (TTA) in the management of L2 fractures, which is the lowest limit of this procedure.

### Methods

All patients underwent spinal decompression, reconstruction and instrumentation by the TTA. Seven patients had combined anterior and posterior instrumentation. The MACS-TL system was used for spinal instrumentation.

### Results

TTA provides excellent access to the entire TLJ, permitting procedure for upper part of L3. Aggressive diaphragmatic opening and repair can be accomplished safely and effectively without special endoscopic instrumentation. We encountered no diaphragmatic herniations.

### Conclusion

TTA provides excellent access to the entire TLJ, permitting satisfactory spinal decompression, reconstruction and instrumentation. In L2 burst fracture, Diaphragmatic opening and repair can be accomplished safely and effectively without special endoscopic instrumentation. It also precludes the need for retroperitoneoscopic or open thoracoabdominal approaches and thus avoids the associated significant morbidity.

EP-037

## Wide Decompressive Craniectomy in Traumatic SDH with Multiple Dural Fenestration Technique

Jongtae Park, Eunsung Park

Wonkwang University Hospital

### Objective

To the better surgical outcome, we performed combined operation with multiple dural fenestration and wartime wide decompressive craniectomy in traumatic SDH.

### Methods

In patients with severe intracranial hypertension with traumatic SDH and contusionional ICH, we performed combined operation with multiple dural fenestration and wartime wide decompressive craniectomy in traumatic SDH for more rapid and wide surgery.

### Results

This operation is a more rapid and wide decompressive surgery in SDH and contusionional ICH pts.

### Conclusion

There are so many surgical trials for better outcome in severe traumatic SDH and contusionional ICH pts. We performed combined operation with multiple dural fenestration and wartime wide decompressive craniectomy and got a relatively better outcome.

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