

**THE UTILITY OF MRI IN PANCREATIC INJURY  
PATIENTS REQUIRING SURGERY: INSIGHTS FROM A  
TQIP ANALYSIS**

Chih-Yuan Fu, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** In addition to the CT scan, which serves as a standard diagnostic modality for pancreatic injuries, MRI could provide more information for the evaluation of pancreatic injuries. In the current study, we aimed to assess the role of MRI in pancreatic injuries requiring surgical treatment using a nationwide database.

**Methods:** The Trauma Quality Improvement Program (TQIP) database was queried to investigate patients with pancreatic trauma who underwent pancreatic surgeries from 2017 to 2019. Characteristics and the time from emergency department (ED) arrival to pancreatic surgery of patients with and without an MRI study before the surgery were compared. A subset analysis was performed for patients who received an MRI study before pancreatic surgery. Patients who underwent pancreatic surgery within 24 hours and those who underwent surgery over 24 hours after the MRI study were compared.

**Results:** A total of 1,631 patients with pancreatic injuries were included, with a mean time to pancreatic surgery of 12.4 hours. Among them, 714 patients received an MRI study before pancreatic surgery. Compared to patients without an MRI study (N=917), patients with an MRI study before surgery (N=714) had significantly higher abbreviated injury severity (AIS) of the pancreas (4.0 vs. 3.0,  $p=0.001$ ) and a longer time to surgery from ED arrival (28.4 hours vs. 11.6 hours,  $p=0.001$ ). Among patients with an MRI study before pancreatic surgery, over 50% (N=377, 52.8%) had surgery more than 24 hours after the MRI. The comparison between patients who underwent surgery within and over 24 hours after the MRI study showed no significant difference in pancreatic injury severity (4.0 vs. 4.0,  $p=0.086$ ), mortality rate (14.4% vs. 15.7%,  $p=0.063$ ), and hospital length of stay (11.5 vs. 12.6 days,  $p=0.191$ ) between these two groups.

**Conclusion:** The significant role of MRI in surgical decision-making and further surgical planning for blunt pancreatic injury was not observed in the current study. However, an early MRI is suggested for prompt surgical treatment in patients requiring an MRI for the surgical plan.

**THERAPEUTIC HYPOTHERMIA AND HEMORRHAGIC  
RISK IN NON-OPERATIVE BLUNT ABDOMINAL  
TRAUMA PATIENTS: A TRAUMA QUALITY  
IMPROVEMENT PROGRAM STUDY**

Ting An Hsu, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** The hypothermia treatment has been studied extensively for its neuroprotective effects in traumatic brain injury (TBI) patients. However, concerns have been raised regarding the potential for increased hemorrhagic complications in polytrauma patients with concomitant blunt abdominal trauma (BAT) which could be treated conservatively due to the coagulopathy associated with hypothermia.

**Methods:** The TQIP database was queried to study BAT patients who were managed non-operatively from 2016 to 2019. The outcomes were compared between patients who underwent the therapeutic hypothermia for concomitant TBI or not. The primary outcome was the occurrence of delayed intra-abdominal hemorrhage, defined as the need for transcatheter arterial embolization (TAE) or surgical intervention to control bleeding after 24 hours. Propensity score matching (PSM), inverse probability of treatment weighting (IPTW), and multivariate logistic regression (MLR) were employed to account for potential confounders.

**Result:** A total of 354,709 patients were included, with 40 patients who underwent the therapeutic hypothermia for concomitant TBI. Delayed intra-abdominal hemorrhage was observed in 1 patients (2.5%, 1/40) who underwent the therapeutic hypothermia. Both well-balanced PSM and IPTW analyses demonstrated no significant difference in the probability of intra-abdominal hemorrhage between the two groups. Furthermore, MLR analysis revealed that the therapeutic hypothermia did not increase the probability of intra-abdominal hemorrhage for non-operatively managed BAT patients.

**Conclusion:** In polytrauma patients with BAT and TBI, the risk of hemorrhage was not observed in patients who underwent a therapeutic hypothermia. These findings suggest that therapeutic hypothermia can be safely implemented in this patient population, provided appropriate monitoring and management of potential coagulopathy are maintained.

**THE HYBRID EMERGENCY ROOM SYSTEM (HERS)  
FACILITATES EFFECTIVE USE OF THE RESUSCITATIVE  
ENDOVASCULAR BALLOON OCCLUSION OF THE  
AORTA (REBOA) FOR ABDOMINAL TRAUMA PATIENTS  
IN HEMORRHAGIC SHOCK**

Kaori Ito, MD

Invited Moderator: Enrique Ginzburg, MD

**Background:** After the installation of the hybrid emergency room system (HERS) in July 2017 at our institution, the resuscitative endovascular balloon occlusion of the aorta (REBOA) can be safely implanted under fluoroscopic guidance, and a protocol has been developed that is explicit regarding its indications in April 2018. In this study, we investigated the evolution of aortic control methods for abdominal trauma patients presenting with hemorrhagic shock before and after the installation of the HERS and examined the frequency of REBOA use and its clinical outcomes.

**Methods:** A retrospective review of trauma patients presented with hemorrhagic shock and underwent trauma laparotomy at our institution from April 2013 to October 2023 was conducted. The method of aortic control (resuscitative thoracotomy vs REBOA) before the installation of HERS (pre-HERS era: April 2013 to June 2017) and after the installation of the HERS protocol (HERS era: April 2018 to October 2023) were reviewed. Outcomes were compared between two groups.

**Results:** The number of trauma surgeries was 105 in the pre-HERS era and 264 in the HERS era. Of these, 25 emergency trauma laparotomies were performed for patient with hemorrhagic shock in the pre-HERS era, and 37 in the HERS era. Compared to the pre-HERS era, the frequency of REBOA se increased (4% [1/25] vs. 27% [10/37],  $p=0.02$ ), and the frequency of resuscitative thoracotomy decreased (28% [7/25] vs. 22% [8/37],  $p=0.57$ ) in the HERS era. In addition, 70% [7/10] of cases of REBOA use in the HERS era were prophylactically implanted prior to laparotomy to prevent cardiac arrest due to massive hemorrhage. Mortality in patients who required aortic control tended to be lower in the HERS era than in the pre-HERS era (88% [7/8] vs 50% [9/18],  $p=0.70$ ).

**Conclusion:** After the installation of HERS and the establishment of protocols defined the indications for REBOA, the frequency of early prophylactic placement of REBOA increased, the frequency of resuscitative thoracotomy decreased, and mortality of patients who required aortic control trended downward. Protocolized prophylactic use of REBOA in the HERS may improve outcomes of patients in hemorrhagic shock due to abdominal trauma.

**TRANSCATHETER ARTERIAL EMBOLIZATION FOR  
BLUNT SPLENIC INJURY: INCIDENCE OF  
PSEUDOANEURYSMS AND ADDITIONAL  
EMBOLIZATION**

Fuminori Yamaji, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** Transcatheter arterial embolization (TAE) is an effective treatment for blunt splenic injuries with good outcomes. However, the need for follow-up and approach to subsequent pseudoaneurysms remain unclear.

**Objective:** This study aimed to investigate the need for follow-up after TAE for blunt splenic injuries and additional embolization of pseudoaneurysms.

**Methods:** The electronic medical records of patients with blunt splenic injuries who were transported to our hospital between 2018 and 2023 were retrospectively reviewed.

**Results:** This study included 66 patients, with a mean age of 41 years. The injury mechanisms included traffic accidents (28 cases), falls from heights (20 cases), snowboarding-related trauma (10 cases), and other causes (eight cases). According to the 2018 revised American Association for the Surgery of Trauma-Organ Injury Scale, there were 14, 10, 16, 17, and 9 grades I, II, III, IV, and V injuries, respectively. TAE/surgery was performed in 2/0 cases of grade I, 2/2 cases of grade II, 4/0 cases of grade III, 16/0 cases of grade IV, and 2/7 cases of grade V. Patients undergoing TAE and conservative treatment as nonoperative management underwent a follow-up contrast computed tomography after approximately 8 days. Pseudoaneurysms developed in two grade I cases (14%), two grade II cases (25%), seven grade III cases (43%), four grade IV cases (23%), and one grade V case (50%). Among these, 13 cases (81%) underwent additional embolization. Thereafter, no apparent reruptures were observed.

**Conclusion:** Follow-up of the development of pseudoaneurysms is important in cases of blunt splenic injury. Moreover, additional embolization of pseudoaneurysms may be effective in preventing re-rupture.

**THE DECISION OF DIAGNOSTIC MODALITIES IN THE  
EVALUATION OF PELVIC FRACTURE PATIENTS WITH  
HEMATURIA**

Yu-Kuan Yang, MD

Invited Moderator: Enrique Ginzburg, MD

**Background:** In evaluating patients with pelvic fractures, the possibility of associated lower urinary tract injuries (LUTIs) should be considered, especially in patients presenting with hematuria. Primary physicians face dilemmas in distinguishing between bladder and urethral injuries, as the diagnostic modality and subsequent treatments differ. This study evaluates the role of computed tomography (CT) scans, a common imaging study in the emergency department (ED), for identifying LUTIs in pelvic fracture patients with hematuria.

**Methods:** Pelvic fracture patients presenting with hematuria during the study period from January 2009 to December 2021 were retrospectively reviewed. We compared characteristics between patients with bladder injuries and urethral injuries. The focus was on the diagnostic tool and timing of LUTI diagnosis. A subset analysis was performed on bladder injury patients who underwent an initial CT scan in the ED, comparing those with positive and negative results.

**Results:** A total of 2,865 patients with pelvic fractures were studied. The proportions of bladder injury, urethral injury, and both injuries were 60 (53%), 46 (41%), and 7 (6%), respectively. Compared with patients with bladder injuries, a significantly higher proportion of urethral injury patients were male (98% vs. 63%,  $p=0.001$ ). The proportion of bladder injuries diagnosed by CT scan was significantly higher than that of urethral injuries (60% vs. 20%,  $p=0.001$ ). Conversely, retrograde urethrography was the dominant diagnostic tool for urethral injuries. Of the bladder injury patients who underwent a CT scan ( $N=36$ ), only 3% were diagnosed after leaving the ED, while less than 10 patients (42%) could be diagnosed in the ED without a CT scan ( $p=0.001$ ).

**Conclusion:** An early CT scan is recommended for the management of pelvic fracture patients with hematuria, particularly for female patients. For male patients, both urethrography and CT scans are necessary in the ED.

**TIMING MATTERS: EVALUATING THE IMPACT OF  
DELAYED PANCREATIC SURGERY OUTCOMES IN  
PANCREATIC TRAUMA PATIENTS – A TQIP DATABASE  
ANALYSIS**

Yu Chi Kuo, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** The decision to undergo pancreatic surgery for pancreatic trauma remains challenging due to the necessity for multiple imaging surveys or attempts at non-surgical treatments before resorting to surgery. However, complications may arise without timely surgery for pancreatic trauma. In this study, we aim to evaluate whether delayed pancreatic surgery results in poor outcomes for patients with pancreatic trauma.

**Methods:** The Trauma Quality Improvement Program (TQIP) database was queried to investigate patients with pancreatic trauma who underwent pancreatic surgeries from 2021 to 2022. The time from emergency department (ED) arrival to pancreatic surgery was analyzed. Mortality, sepsis, acute kidney injury (AKI), and hospital length of stay (LOS) were compared between patients who underwent pancreatic surgery within 12 hours or after 12 hours from ED arrival. Propensity score matching (PSM) and inverse probability of treatment weighting (IPTW) were employed to account for potential confounders.

**Results:** A total of 854 patients with pancreatic injuries were included, with a mean time to pancreatic surgery of 12.4 hours. Among them, 240 patients underwent pancreatic surgery after 12 hours. In this group, sepsis and AKI were observed in 17 (7.1%) and 25 (10.4%) patients, respectively. Both well-balanced PSM (208 vs. 208 patients) and IPTW analyses demonstrated that patients undergoing pancreatic surgery after 12 hours from ED arrival had significantly longer hospital LOS, higher sepsis rates, and higher AKI rates than patients who underwent pancreatic surgery within 12 hours from ED arrival. Subset analysis for patients who underwent pancreatic surgery within 12 hours showed that the incidence of sepsis ( $p=0.717$ ) and AKI ( $p=0.264$ ) did not increase with the increment of time to surgery in hours.

**Conclusion:** Patients undergoing pancreatic surgery beyond 12 hours exhibited elevated risks of sepsis and AKI, along with extended hospital stays. Prompt diagnosis and surgical intervention are vital for reducing complications in patients with pancreatic injuries.

**REDUCING THE TREATMENT LEVEL OF PATIENTS  
WITH MAJOR TORSO HEMORRHAGE: THE ROLE OF  
REBOA IN A LEVEL-I TRAUMA CENTER**

Kuo-Chien Lee, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** Resuscitative endovascular balloon occlusion (REBOA) offers temporary hemodynamic stabilization until definitive surgical bleeding control is possible. Existing literature suggests that REBOA may effectively extend survivability in severely injured trauma patients requiring interfacility transfer to a facility with definitive hemorrhage control capabilities. However, its role in a high-level trauma center, capable of providing extensive resuscitation and immediate hemostatic procedures, needs clarification.

**Methods:** A retrospective review was conducted on patients with abdominal/pelvic hemorrhage-associated unstable hemodynamics, primarily sent to a level-I trauma center from 2017 to 2022. Comparisons of time to definitive hemostasis, hemostatic procedures, and outcomes were made between patients who underwent REBOA and those who did not. A subset analysis was performed for patients with pelvic fracture-related life-threatening hemorrhage, comparing patients with and without REBOA.

**Results:** A total of 82 patients with abdominal/pelvic hemorrhage and unstable hemodynamics were studied. Thirteen patients (15.9%) underwent REBOA prior to hemostasis interventions. There was no significant difference in the time to definitive hemostasis between patients with and without REBOA (Surgery: 73.3 vs. 89.8 minutes,  $p > 0.05$ ; Angioembolization: 113.9 vs. 113.3 minutes,  $p > 0.05$ ). Among patients with intra-abdominal hemorrhage ( $N=47$ ), 60% of those with REBOA underwent angioembolization for hemostasis, while only 28.6% without REBOA underwent angioembolization, with 71.4% requiring laparotomies for hemostasis. In patients with pelvic fracture-related retroperitoneal hemorrhage, typically requiring angioembolization, the mean systolic blood pressure (SBP) increased from 47 to 100 mmHg after REBOA placement. There was no significant difference in SBP before angioembolization between patients with and without REBOA (100 vs. 107 mmHg,  $p > 0.05$ ).

**Conclusion:** In a fully equipped level-I trauma center, REBOA did not prolong the time to definitive hemostasis. Lifesaving angioembolization for pelvic fracture-related retroperitoneal hemorrhage could be successfully performed in patients with REBOA. Additionally, reduced treatment for intra-abdominal hemorrhage was observed with REBOA application.

**A PREDICTION MODEL OF MORTALITY AMONG  
CIRRHOTIC PATIENTS WITH BLUNT ABDOMINAL  
TRAUMA: A SINGLE-CENTER RETROSPECTIVE STUDY**

Mo-Han Lin, MD

Invited Moderator: Enrique Ginzburg, MD

**Purpose:** Liver cirrhosis is recognized as a detrimental factor in patients with blunt abdominal trauma (BAT). This study aims to evaluate factors contributing to mortality in cirrhotic patients with BAT and develop a corresponding prediction model.

**Methods:** A retrospective observational study of BAT patients from May 2008 to December 2022 in a level-I trauma center was conducted. Propensity score matching (PSM) was performed at a 1:2 ratio to compare mortalities, bleeding-related complications, length of stay (LOS), and intensive care unit (ICU) LOS between patients with and without pre-existing cirrhosis. A subset analysis using multivariate logistic regression (MLR) was conducted to identify independent factors of mortality among cirrhotic patients.

**Results:** Out of 5,705 BAT patients, 88 (1.5%) had pre-existing cirrhosis. Well-balanced PSM revealed that patients with cirrhosis had significantly higher mortality rates (21.3% vs. 6.8%, p-value less than 0.001) and bleeding-related complication rates (31.8% vs. 19.9%, p=0.032). Among BAT patients with liver cirrhosis (N=88), MLR analysis demonstrated that the PT-INR and Creatinine levels were independent factors of mortality. A 0.1 unit increase in PT-INR raised the odds of mortality by 58.2% (odds ratio=1.582, 95% CI: 1.244–2.012, p-value less than 0.001), while a 1mg/dL rise in Creatinine level increased the odds of mortality by 90.3% (odds ratio=1.903, 95% CI: 1.082–3.347, p=0.026).

**Conclusions:** Cirrhotic patients exhibited a statistically significant higher mortality rate and bleeding-related complication rate than non-cirrhotic population. PT-INR and Creatinine levels are identified as predictors of mortality for cirrhotic patients with BAT.



**EXPLORING THE THERAPEUTIC ROLE OF  
LAPAROSCOPY IN ANTERIOR ABDOMINAL STAB  
WOUNDS**

Chien Wu, MD

Invited Moderator: Enrique Ginzburg, MD

**Introduction:** Traditional management of abdominal stab wounds with peritoneal violation typically involves exploratory laparotomy. However, our previous research comparing laparoscopy and laparotomy in managing anterior abdominal stab wounds (AASWs) suggested that laparoscopy is a safe and effective method, fulfilling both diagnostic and therapeutic needs.

**Methods:** We conducted an analysis of patients with AASWs and peritoneal violation who underwent diagnostic laparoscopy initially over the past 26 years. Logistic regression was utilized to identify factors predicting the need for further therapeutic procedures.

**Results:** A total of 94 patients with AASWs and peritoneal violation underwent initial diagnostic laparoscopy. Among them, 50 patients (53.2%) required therapeutic procedures. The median operation time was 117.5 minutes, and the median length of hospital stay was 6 days. Initial systemic blood pressure, heart rate, serum hemoglobin level, and presence of bowel evisceration were not significantly associated with the need for therapeutic procedures. However, a history of assault by others was found to be a negative predictive factor (odds ratio= 0.309, p-value= 0.018) for therapeutic laparoscopy. Conversion to laparotomy occurred in 4 patients, primarily due to severe injuries to hollow organs and solid organs in the bare area.

**Conclusion:** Laparoscopy demonstrates significant therapeutic potential in managing AASWs with peritoneal violation. However, careful consideration is required for severe organ injuries, potentially leading to conversion to laparotomy.

**DIAGNOSIS AND TREATMENT OF TRAUMATIC  
ISOLATED BLUNT GRADE III PANCREATIC INJURY**

Miho Iwai, MD

Invited Moderator: Enrique Ginzburg, MD

**Case:** A 48-year-old man, who was getting drunk and probably falling and went to sleep. He woke up with an abdominal pain, and he came to the hospital the next day. On arrival, contrast-enhanced CT revealed that there was an increase in the concentration of surrounding fat tissue and accumulation of ascites that appeared to be bloody were observed between stomach and pancreas. However, as there was no obvious extravasation and vital signs were stable, conservative treatment was chosen as intra-abdominal bleeding was suspected. The next day, abdominal pain worsened and generalized. CT follow-up showed a tendency for ascites to increase in volume. Ascitic fluid puncture was performed and a markedly high level of ascitic fluid amylase was found. Emergency surgery was performed for generalized peritonitis and the pancreatic tail was completely ruptured. Based on the general condition and surgical findings, a pancreatic body and tail and splenectomy were performed. Postoperatively, the pancreatic fistula was mild, and the patient was discharged home on POD 20.

**Discussion:** Pancreatic injuries are relatively rare, accounting for 2-16% of abdominal injuries, and in Japan, blunt trauma accounts for about 90%. In particular, Grade III injuries with main pancreatic duct injury have a high mortality rate. The presence or absence of damage to the main pancreatic duct is important as an indication for surgery, and ERCP may need to be considered in some cases, but in cases where the mechanism of injury is unclear and diagnosis is difficult due to blunt pancreatic isolated trauma, measurement of ascitic fluid amylase levels may assist in simple diagnosis. Although there is still no consensus regarding the surgical method for Grade III, in this case there was severe collapse of the pancreatic tail, and it is possible to minimize pancreatic fistula by performing splenectomy at the pancreatic body and tail and ensuring drainage.

**Conclusion:** It is necessary to use multiple methods for early diagnosis and to consider appropriate surgical techniques for traumatic isolated blunt Grade III pancreatic injury.

**ANALYSIS OF THE CURRENT USAGE OF  
RESUSCITATIVE ENDOVASCULAR BALLOON  
OCCLUSION OF THE AORTA (REBOA) IN PEDIATRIC  
TRAUMA PATIENTS: A RETROSPECTIVE STUDY FROM  
THE ACS-TQIP DATABASE**

Ling-wei Kuo, MD

Invited Moderator: Julia Coleman, MD

**Background:** Resuscitative endovascular balloon occlusion of the aorta (REBOA) has been an established life-saving procedure for adult trauma patients, but the evidence for its use in pediatric patients is still under question. The purpose of this study was to examine the outcome of REBOA in pediatric patients.

**Methods:** We retrospectively analyzed observational cohort data from the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) from 2017 to 2019. We analyzed 183,506 trauma patients under the age of 18 years old, and 129 patients were matched by propensity score analysis. Basic demographics, injury severity and mechanism, and clinical outcomes of the patients who received REBOA and those who did not receive REBOA were compared. In the REBOA patients, a subgroup analysis was performed to evaluate the potential influence of age and body weight on the outcomes of REBOA.

**Results:** After the demographics and pretreatment factors were balanced for the REBOA and no-REBOA groups, the patients in the REBOA group had more PRBC transfusion requirements in the first 4 hours (3250 ml vs. 27 ml,  $p=.001$ ), and the mortality rate was significantly higher in the REBOA group (55.8% vs. 36.0%,  $p=.039$ ). No significant difference was detected regarding in-hospital complications. In the subgroup analysis of the patients who received REBOA, we discovered no significant difference in demographics and outcomes between the subgroups when compared by age (15 years old as cutoff) or by weight (56 kg as cutoff).

**Conclusions:** The use of REBOA was associated with an increased risk of mortality among the pediatric patients when the REBOA patients were compared with the non-REBOA patients, despite the patients' basic demographics and pretreatment factors being matched. Younger age and lighter body weight did not seem to influence the outcomes of REBOA regarding survival and complications.

**FIBRINOGEN EARLY IN SEVERE PAEDIATRIC TRAUMA  
STUDY (FEISTY JUNIOR): A RANDOMISED CLINICAL  
TRIAL**

Shane Geroge, MD

Invited Moderator: Julia Coleman, MD

**Introduction:** Early replacement of fibrinogen in paediatric haemorrhage has been reported to reduce 24-hour mortality. The time taken to deliver fibrinogen replacement has been studied in adults, with a median of 60mins for cryoprecipitate (cryo), and 29min for Fibrinogen concentrate (FC). There are no published studies comparing FC and cryoprecipitate in the children.

**Methods:** This is a prospective multi-centre, randomised study enrolling children aged 3-months to 18-years with traumatic haemorrhage. Eligible patients were allocated to receive FC or cryo in patients with a FIBTEM A5 of  $\leq 10$ mm. All other aspects of the current ROTEM guided treatment and damage-control approach were unchanged (Figure 1, 2). The primary outcome was time to administration of fibrinogen replacement from time of identification of hypofibrinogenaemia. Clinical secondary and feasibility outcomes were also analysed.

**Results:** 67 patients were included in the final analysis (Figure 3). Patients were similar at baseline in both groups (Table 1). There was no significant difference in the time to administration of FC (62min, 95% CI 33-100) or Cryo (65 mins, 95%CI 47-77). There was also no difference in red cell, plasma or platelet use at 6 and 24 hours. Thromboembolic adverse events were similar between groups. 90-day follow up data was collected for 51 participants. Analysis of response to fibrinogen replacement is ongoing.

**Conclusions:** The time to administer FC in children is longer than that reported in adults. The reasons for this are likely to be multifactorial and represent complex interplay between patient and system factors. Further analysis of this data set will aim to identify and explore contributing factors to this observed difference. Importantly there is no difference in blood product use and adverse events between the two products. Outcomes of this preliminary study provide support for the use of FC in regional and remote centres without access to frozen blood products.

**DOES CRYOPRECIPITATE TRANSFUSION IMPROVE  
THE SURVIVAL OUTCOME OF BLUNT TRAUMA? A  
SINGLE TRAUMA CENTER RETROSPECTIVE STUDY IN  
JAPAN**

Sung Ho Kim, MD

Invited Moderator: Julia Coleman, MD

**Introduction:** Administering fibrinogen is crucial in managing traumatic coagulopathy. Cryoprecipitate, a concentrated form of frozen fibrinogen, is expected to expedite hemostasis and improve survival chances. However, there is limited evidence regarding its impact on survival rates. We hypothesized that patients with blunt trauma who received cryoprecipitate transfusion would exhibit a higher 28-day survival rate compared to those receiving conventional transfusion.

**Methods:** This study conducted a single-center retrospective analysis. We included all patients with blunt trauma directly brought in from the scene between April 2013 and March 2020 who underwent emergency transfusions. Patients receiving cryoprecipitate transfusions were compared to those receiving conventional transfusions. The primary outcome measure was the 28-day survival rate. Logistic regression analyses were conducted, adjusting for potential confounders with 95% confidence intervals.

**Results:** A total of 208 patients were included in the analysis. The median age was 60 years (IQR: 38.00-70.25), with 138 (66.3%) being male. One hundred eighteen patients received cryoprecipitate transfusions, while 90 received conventional transfusions. The median probability of survival, as measured by the Trauma Injury Severity Score (TRISS), was 0.52 (IQR: 0.19-0.89), with a tendency to be lower in the control group. However, there was no statistically significant difference in the 28-day survival rate between the two groups (74.6% vs. 71.1%, odds ratio 1.19, 95% confidence interval [0.644-2.21]). Multivariate logistic regression analysis, adjusted for TRISS and the presence of traumatic brain injury determined by an Abbreviated Injury Scale (AIS) score of 3 or more, revealed that cryoprecipitate did not improve the 28-day survival rate (odds ratio 0.688, 95% confidence interval [0.309-1.53]).

**Conclusion:** In this single-center retrospective study, cryoprecipitate transfusion did not demonstrate a significant improvement in the 28-day survival rate among patients with blunt trauma.

**PREVALENCE OF TRAUMA-INDUCED COAGULOPATHY  
DIAGNOSED USING THROMBOELASTOGRAPHY IN A  
REGIONAL HOSPITAL IN THE PHILIPPINES**

Ma Corazon Cabanilla-Manuntag, MD

Invited Moderator: Julia Coleman, MD

**Background:** Trauma remains to be a global threat to public health worldwide and mortalities remain significant especially in third world countries. To manage this, a lot of research is being done to further manage mortality-associated with trauma, protocols for resuscitation are being studied. An active area of research is identifying trauma-induced coagulopathy (TIC) is still an area of active research for both laboratory and clinical data. Generally, it is regarded as an abnormal process of coagulation mainly attributed to severe traumatic injuries. And while trauma remains to be a public health concern worldwide, much of what is known about TIC comes from only from mature trauma systems.

**Objective:** This study explored the prevalence of TIC in Filipino patients admitted in a tertiary regional hospital using deranged parameters in thromboelastography (TEG) and prothrombin time and INR for conventional coagulation assay (CCA).

**Methodology:** From July 2023 to January 2024, sixty six patients met the trauma admission criteria and blood samples for TEG, CCA, arterial blood gas, and complete blood count were taken simultaneously. TEG results were interpreted by the intensivist.

**Result:** TIC was diagnosed in a total of thirty patients (45.45%), eleven using only TEG (16.67%), fifteen patients using only CCA (22.72%), and four patients using both (6.06%). Mortality was highest when TIC was diagnosed using both assays (100%) but between TEG and CCA, correlation with mortality was higher with TEG (45% vs 13%). Average length of stay were 14.6 days, 11 days, and less than 24 hours for those diagnosed with TIC using CCA, TEG, and both, respectively.

Average initial blood transfusion requirements at the emergency department were 2 units, 2 units, and 5.5 units for patients with TIC diagnosed using CCA, TEG, and both, respectively.

**Conclusion:** The prevalence of TIC is higher for this population than previously reported. Patients diagnosed with TIC had poorer outcomes, especially when diagnosed using both assays. TEG and CCA should be done on severe trauma patients for guidance in both resuscitation and prognostication.

**ANALYZING ADVERSE EVENTS IN TRAUMA  
RESUSCITATION: IMPLEMENTING A DATA-DRIVEN  
APPROACH FOR IMPROVED PATIENT CARE AND  
SAFETY**

Anisa Nazir, MD

Invited Moderator: Julia Coleman, MD

**Background and Objectives:** Errors in trauma care manifest during the initial resuscitation phase in the trauma bay. Identifying trauma adverse events (AEs) poses challenges due to the time-sensitive, high-stress environment, retrospective data collection, and potential underreporting by healthcare providers. The STAT (Safety Threats and Adverse Events in Trauma) taxonomy categorizes 65 trauma resuscitation AEs into nine distinct groups. The objective of this study is to characterize AEs and latent safety threats in trauma using the STAT taxonomy.

**Methods:** A prospective cohort observational study at St. Michael's Hospital investigated consecutive trauma team activations over four months, employing an audio-visual data capture system. The study spanned activities from 10 minutes pre-arrival to departure in the trauma bay. Participants consented to the recording and analysis of trauma resuscitation, with detailed documentation of all aspects. Three independent raters conducted the data analysis, aiming to bolster reliability by mitigating subjectivity and enhancing objectivity in the results.

**Results:** The preliminary analysis of the STAT taxonomy application reveals intriguing patterns in AEs and errors within the trauma bay. A total of 410 adverse events were identified among the 197 enrolled patients. This resulted in an average of approximately 2.08 adverse events per case. These events encompassed a range of factors, including procedural complications, communication errors, equipment malfunctions, and contextual challenges within the trauma bay setting. Most common AEs identified are ID bracelet (n=43, CI= (0.16, 0.275), failure to draw bloodwork within 10 minutes of arrival (n=41, CI=( 0.15, 0.26), close loop communication (n=22, CI=(0.06, 0.16), concurrent conversations preventing team leader communication (n=27, CI=(0.89, 0.185), patient assessment begins before EMS handover in stable patient (n=22, CI=(0.07, 0.15) and unclear team roles (n=20, CI=(0.06, 0.14).

**Conclusions:** The initial application of the STAT taxonomy to trauma videos has provided insight into the intricacies of trauma resuscitation. These early insights have already revealed distinctive error patterns, emphasizing the role of prospective analysis in improving patient safety within trauma settings. The most common AEs pinpoint specific areas that might benefit from targeted interventions or process improvements. Further correlation with registry data is crucial to identify patterns and impacts on patient outcomes.

**THE DIAGNOSTIC ACCURACY OF FAST CT IN THE  
COMPUTED TOMOGRAPHY FIRST RESUSCITATION  
STRATEGY WITH HYBRID EMERGENCY ROOM  
SYSTEM FOR SEVERELY TRAUMA PATIENTS**

Satomi Senoo, MD

Invited Moderator: Julia Coleman, MD

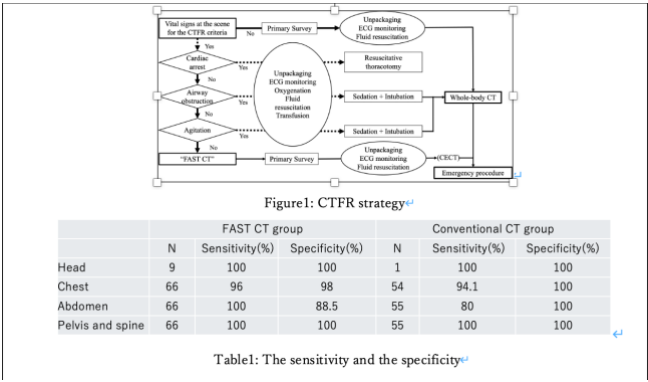
**Introduction:** The introduction of hybrid emergency room system (HERS) with high-speed computed tomography (CT) scan has dramatically changed the management for severely injured patients in some centers in Japan. We developed CT first resuscitation (CTFR) strategy in HERS with the goal of minimizing the time to identification of critical injuries and the definitive treatment (Fig1) . FAST CT is a method of CT scan that prioritizes scan time and scan the whole body (from head to pelvis) in a non-contrast enhanced CT, which differs from non-contrast enhanced conventional whole body CT scan. The purpose of this study is to evaluate the diagnostic accuracy difference between the FAST CT scan and conventional whole body CT scan in trauma patients.

**Method:** Over a period of two years, from January 2020 to December 2022, we divided blunt trauma cases aged over 20y.o and AIS 3 or higher, who were admitted to HERS, into two groups: the FAST CT group and the conventional CT group. Demographics, injury patterns, outcomes, radiation dose, and the diagnostic accuracy of CT examinations in both groups retrospectively.

**Result:** 121 patients who met the inclusion criteria were identified: 66 in the FAST CT group and 55 in the conventional CT group. There were no significant differences observed in patient's characteristics and outcomes between the two groups. The radiation dose was significantly lower in the FAST CT group [2173 (2159.2-2251.4) vs 3411.8 (2815.6-3765.7) mGy•cm:  $P < 0.01$ ]. The sensitivity/specificity of CT scan in each group were as follows: head (100%/100% vs 100%/100%), chest (96%/98% vs 94.1%/100%), abdomen (100%/88.5% vs 80%/100%), and pelvis and spine (100%/100% vs 100%/100%) (Table1).

**Conclusion:**

Although the radiation dose of FAST CT scan in the CTFR strategy was significantly lower than that of the conventional CT scan, its diagnostic accuracy was the same as that of conventional whole-body CT scan. Further studies are needed to increase the number of cases.





# **FIRST-2 TRIAL: FACTORS IN THE INITIAL RESUSCITATION OF SEVERE TRAUMA. A 2020 EAST MULTICENTER TRIAL**

Luis da Luz, MD

Invited Moderator: Julia Coleman, MD

**Background:** Bleeding trauma patients with coagulopathy have a three-fold increased mortality risk, which has prompted renewed research interest in the optimal transfusion strategy for trauma-induced coagulopathy. We aimed to compare efficacy/safety of using clotting factor concentrates (CFCs) with the standard ratio-based plasma strategy.

**Methods:** Randomized, controlled, superiority trial, at six Level 1 Trauma Centers (April 2021-January 2023) with a pre-planned interim analysis for futility and sample size check after enrollment of 120 randomized/treated/consented patients. Inclusion: patients with massive hemorrhage protocol (MHP) activation at admission. Randomization: computer generated, stratified by center, using closed opaque envelopes for rapid allocation. Intervention: CFC (fibrinogen concentrate [FC] 4g and prothrombin complex concentrate [PCC] 2000 IU) in MHP packs 1+2. Control: 4U frozen plasma [FP] (packs 1+2). Concomitant therapy: 4U RBC (packs 1+2), and 1 adult dose platelets (pack 2, transfused as per clinician discretion). Outcomes: Primary, blood products (RBCs, FP, platelets) administered within 24 hours (powered to detect difference of 5U RBC between arms); Secondary, efficacy/safety (24-hour, 28-day mortality, thromboembolic events [TE], among others).

**Results:** The study was terminated following interim analysis, indicating low conditional

Table - FiiRST-2 Study (NCT04534751): Details on intervention, active control, and outcomes.

Characteristic	Plasma, No. (%) (n=71)	FC and PCC, No. (%) (n=66)	Effect estimates	
			LS mean ratio (FC+PCC/plasma, 1-sided 97.5% CI, superiority)	P value
Primary outcome				
Red cells + plasma + platelets within 24h (LS mean, 95% CI)	23.8 (19.2 - 29.4)	20.8 (16.7 - 25.9)	0.87 (0.0 to 1.19)	0.20
Median (IQR)	12.0 (8, 31)	11.0 (6, 23)		
Secondary outcome – mortality				
24-hour mortality, n (%)	12 (16.9)	5 (7.6)		0.25
28-day all-cause mortality, n (%)	15 (21.1)	9 (13.6)		0.25
Secondary outcome – thromboembolic events (TE)				
TE complications at 28 days n (%)	n (%), 95% CI) 10 (14.1, 6.97-24.4)	n (%), 95% CI) 14 (21.2, 12.1 - 33.0)	Risk difference 7.13 (-5.9 - 20.6)	P 0.37

Abbreviations: CI – confidence interval, FC – fibrinogen concentrate, IQR – interquartile range, LS – least mean, PCC – prothrombin complex concentrate.

treatment dose in first pack in 89.4% and 66.2%, respectively, before MHP termination or death. The mean 24-hour units of blood products was 20.8 and 23.8 in the CFC and FP groups, respectively (Table). TE occurred in 14(21.2%) and 10(14.1%) of patients in the CFC and FP groups, respectively. However, no differences were found when adjusted for numerically more survivors in the CFC arm (p=0.46). There were no differences in 24-hour and 28-mortality (Table).

**Conclusion:** The use of CFCs as part of the initial MHP in trauma patients did not demonstrate superiority in 24-hour blood product administration. Future trials should investigate different sources of CFCs and compare with plasma, evaluating their impact on important outcomes

power of the test statistic for the primary outcome for superiority. In the full analysis, 217 patients were randomized and 137(66 CFC/71 plasma) were treated and included in the primary analysis. Demographics/injury severity: median age (interquartile range, IQR) 38(29-55) years; 81% men; 66% blunt mechanism; median (IQR) ISS 29(19.5-43). CFC and plasma patients received full

**OUTCOMES AFTER REVISED BLOOD TRANSFUSION  
POLICY DURING CRITICAL NATIONAL BLOOD  
SHORTAGE**

Makenna Marty, MD

Invited Moderator: Julia Coleman, MD

**Introduction:** During the national blood shortage in 2021, [redacted]'s blood bank adopted a restricted transfusion policy. This prompted the following after a PRBC order: hemoglobin  $>6.5$  g/dL prompted clinician to reconsider transfusion; and hemoglobin 5.5-6.5 g/dL was given one unit only. This study aims to evaluate hemodynamics and blood product usage of patients under the restrictive transfusion policy.

**Methods:** A retrospective chart review was performed for inpatients from January to March 2022 with a Hgb  $\leq 7.0$  g/dL. Exclusion criteria were age under 18 years, pregnancy, active bleeding, death prior to intervention, and incomplete data.

**Results:** 227 identified patients had a hemoglobin of  $\leq 7.0$  during the specified time frame. 42 were excluded. Of the 185 included, 64 (34.5%) were transfused according to policy and stratified based on degree of anemia (Table 1). 121 (65.4%) received unindicated transfusions. There were no significant differences across groups in age, sex, comorbid conditions, antiplatelets, anticoagulants, or pre-transfusion platelets or INR. Primary outcomes included hemodynamic changes (new-onset tachycardia or hypotension) and need for repeat transfusion (Table 2). Secondary outcomes included mortality and length of stay (Table 3). Results showed no difference in hemodynamics between groups (HR  $p=0.798$ , SBP  $p=0.935$ ) or mortality ( $p=0.661$ ). The most-restricted groups were more likely to need re-transfusion based on immediate next hemoglobin ( $p=0.026$ ) and need for re-transfusion at any point during remainder of inpatient stay ( $p=0.001$ ) and increased length of stay ( $p=0.042$ ).

**Conclusions:** The number of patients who were given transfusions that were not aligned with the restrictive guidelines (34.5%) was higher than anticipated, indicating clinician judgment often guided transfusion over policy. For patients transfused according to policy, they demonstrated a significant increased need for re-transfusion and longer length of stay. Despite a second transfusion being somewhat delayed for patients with ongoing blood product needs, there was no significant difference in hemodynamic outcomes or mortality. These data suggest patients may tolerate more restrictive blood transfusions without adverse outcomes when rationing is required to preserve the critical resource of PRBCs, which could prevent overuse of blood products in patients who may not require as much as is currently given per standard of care.

**ABO BLOOD TYPE GROUPS AND OUTCOMES OF  
SEVERE TRAUMA PATIENTS: SYSTEMATIC REVIEW**

Wataru Takayama, Yohei Iwasai, MD

Invited Moderator: Julia Coleman, MD

**Background:** Although it has been reported that ABO blood type has a profound influence on hemostasis, the correlation between blood type and outcomes of severe trauma patients are still under debate.

**Objective:** The purpose of this study was to provide a systematic and comprehensive review of evaluation studies on the impact of ABO blood type on the clinical outcomes in severe trauma patients.

**Methods:** PubMed and Cochrane library were searched for studies investigating the relationship between ABO blood type and outcomes in patients with severe trauma. In this review, meta-analysis was excluded according to the significant study heterogeneity. The study quality was assessed using CASP checklists, the certainty of evidence was evaluated using GRADE, and PRISMA guidelines were followed throughout manuscript.

**Results:** Of 183 potentially eligible relevant records, fourteen studies met inclusion criteria, representing 12,580 patients. Of these studies, statistically significant differences by ABO blood type were reported in 3 studies evaluating all-cause mortality, 2 evaluating exsanguination, and 3 evaluating the amount of transfusion. Included studies had substantial variability in methods and population. Although blood type O tended to be associated with higher mortalities and larger transfusion volume than other blood types, there was significant heterogeneity among studies with certainty of evidence rated as low.

**Conclusions:** There is insufficient evidence to definitively demonstrate an association between ABO blood type and outcomes in severe trauma patients. Further studies elucidating their mechanism underlying this association are needed to establish clinical significance.

## **ROTEM in coagulation management for major trauma patients: Evidence based algorithmic approach**

Vikas Chawla, MD

Invited Moderator: Julia Coleman, MD

Coagulopathy is present in approximately 25-35% of trauma patients on admission to the emergency room. Therefore, major trauma patients face a serious problem that accounts for 40% of all trauma-related deaths. Early and rapid hemostatic treatment is necessary to prevent excessive bleeding and exsanguination in cases of coagulopathy.

TRALI, ascribed to empirical (or non-goal-directed) bleeding management strategy, is the most crucial cause of transfusion-associated mortality and morbidity in trauma patients. Using coagulation factor concentrates can help quickly and effectively correct coagulopathy.

Quick and reliable coagulation monitoring is necessary for goal-directed coagulation treatment of severely bleeding patients, along with a targeted therapeutic approach based on test results. Standard coagulation tests such as PT and aPTT do not offer sufficient insight into complex coagulopathy associated with high blood loss, factor consumption, and hemodilution.

Goal-directed hemostatic therapy using coagulation factor concentrates can help decrease the need for allogeneic blood transfusions, which can negatively affect patient outcomes. In recent years, rotational thromboelastometry (ROTEM), a viscoelastic method that evaluates the speed of clotting and the quality of the clot, has been effectively used to guide hemostatic therapy.

ROTEM enables an accurate and timely assessment of the clotting process and clot quality. Administering coagulation factors promptly and goal-directedly may lead to improved patient outcomes. Most of the major trauma patients show a reduced MCF in the FIBTEM test. Low FIBTEM MCF reflects reduced fibrinogen concentration or disturbed fibrin polymerization. Platelet concentrate should preferably be transfused in patients not responding sufficiently to fibrinogen concentrate/cryoprecipitate (i.e., absence of an adequate increase in EXTEM MCF after administering fibrinogen concentrate/cryoprecipitate). Patients with recent intake of coumarins and patients showing prolonged EXTEM CT (>1.5 times normal) may benefit from an additional 1000 to 1500 U PCC to augment thrombin generation.

**Summary:** FIBTEM MCF less than 10 mm and EXTEM CT > 1.5 times normal can guide the administration of FC and PCC, respectively. Mortality is likely to be associated with FIBTEM less than 7 mm, EXTEM-MCF less than 45 mm; significantly shorter EXTEM-CT, INTEM-CT, EXTEM-CFT, and INTEM-CFT; significantly higher EXTEM-MCF, INTEM-MCF.

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**FEASIBILITY OF RESUSCITATIVE ENDOVASCULAR  
BALLOON OCCLUSION OF THE AORTA FOR  
COMPUTED TOMOGRAPHY DIAGNOSIS: A  
REEVALUATION**

Hiroyuki Otsuka, MD

Invited Moderator: Julia Coleman, MD

**Background:** Advances in medical equipment have led to changes in the management of severe trauma. The role of resuscitative endovascular balloon occlusion of the aorta (REBOA) in this context remains unclear. This study aimed to reassess the utilization of REBOA and the utility of computed tomography (CT) in the context of aortic occlusion in contemporary trauma management. While initially reported in 2021 by J Trauma Acute Care Surg, uncertainties persist and warrant further discussion.

**Methods:** This retrospective observational study, conducted at a single tertiary center in Japan, analyzed 77 patients who experienced severe trauma and persistent hypotension between October 2014 and March 2020.

**Results:** All patients required urgent hemostasis. Twenty patients underwent REBOA, 11 underwent open aortic cross-clamping, and 46 did not undergo aortic occlusion. Among patients who underwent aortic occlusion, 19 underwent pre-hemostasis CT, and 7 underwent operative exploration without pre-hemostasis CT to identify active bleeding sites. The 24-hour and 28-day survival rates in patients who underwent CT were not inferior to those in patients who did not undergo CT (24-hour survival rate, 84.2% vs. 57.1%; 28-day survival rate, 47.4% vs. 28.6%). Moreover, patients who underwent CT had less discordance between the primary hemostasis site and the main bleeding site compared with patients who did not undergo CT (5% vs. 71.4%,  $p = 0.001$ ). In patients who underwent pre-hemostasis CT, REBOA was the most common approach to aortic occlusion. Most bleeding control sites were located in the retroperitoneal space. Many patients underwent interventional radiology for hemostasis.

**Conclusion:** In a limited number of patients whose cardiac arrests were imminent and in whom no active bleeding sites could be clearly identified without CT findings, REBOA for CT diagnosis may be effective. Further studies are recommended.

# IMPACT OF CD4 COUNT ON HIV POSITIVE TRAUMA PATIENTS IN URBAN U.S. CITY

Vanessa Arientyl, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** There is scarce literature investigating the impact of HIV on outcomes for trauma patients. Literature that exists has predominately used national databases and majority have found difference in the rates of complications. This has largely been attributed to modern day use of antiretroviral therapy (ART). We hypothesize those with lower CD4 count would have increased rates of infections and inflammatory related complications.

**Methods:** A retrospective cohort review of patients at a single center between 2018-2023 was performed. Trauma patients with HIV and recorded CD4 count during or within 12 months of admission were included. Demographics, medical history, CD4 count, hospital length of stay and complication records were collected for review. Patients were subsequently categorized into two groups: CD4 lower than 200 (L-CD4) or higher than 200 (H-CD4).

**Results:** The cohort was comprised of 368 patients. The Median (IQR) age was 43 (34-59) years, with 80% males, 81% blunt mechanism and a median ISS of 9 (5-14). The L-CD4 group included 104 (28%) patients, while the H-CD4 had 264. Between groups there was no difference in age, sex, trauma mechanism or ISS. The median CD4 count for L-CD4 was 96 vs 474 for H-CD4. L-CD4 was more likely to have a smoking and drug use history and were less likely to be on ARV at time of admission (58% vs 85%,  $p = 0.001$ ). There was no difference in complications such as DVT, pulmonary embolism, acute respiratory distress, acute kidney injury and pneumonia. L-CD4 was associated with higher rates of sepsis, stroke and hospital length of stay. Overall there was no difference in rates of in-hospital mortality.

**Conclusion:** Our data suggest that HIV positive patients with traumatic injuries and CD4 counts below 200 were at higher risk of stroke and sepsis, but not for other infectious or inflammatory complications. We found that over 25% of our population presented with AIDS defining CD4 counts, with over 40% not on ARV therapy. Additional studies should investigate the influence of ARV adherence on complications and public health interventions to create avenues that increase the use of and access to ARV therapy.

	CD4 > 200 (n = 264)	AIDS (n = 104)	Total N = 368	p value
Age	48 (32.5 - 59.5)	49.5 (38 - 58)	48 (34.5 - 59)	0.277
Gender				0.102
Male	206 (78%)	89 (85.6%)	295 (80.2%)	
Mechanims				0.211
Blunt	208 (78.8%)	90 (86.5%)	298 (81%)	
Burn	1 (0.4%)	0	1 (0.3%)	
Penetrating	55 (20.8%)	14 (13.5%)	69 (18.8%)	
CD4	471 (302 - 678)	96 (53 - 151)	339 (179 - 601)	<0.001
Homeless	68 (25.8%)	37 (35.6%)	105 (28.5%)	0.06
ARV at admission				<0.001
No	39 (14.8%)	43 (41.3%)	82 (22.3%)	
Yes	223 (84.5%)	59 (56.7%)	282 (76.6%)	
Unknown	2 (0.8%)	2 (1.9%)	4 (1.1%)	
Complications				
DVT	1 (0.4%)	0	1 (0.3%)	0.53
PE	3 (1.1%)	2 (1.9%)	5 (1.4%)	0.557
ARDS	2 (0.8%)	1 (1%)	3 (0.8%)	0.845
Pneumonia	5 (1.9%)	2 (1.9%)	7 (1.9%)	0.985
AKI	7 (2.7%)	4 (3.8%)	11 (3%)	0.545
Stroke	1 (0.4%)	3 (2.9%)	4 (1.1%)	0.037
Sepsis	1 (0.4%)	3 (2.9%)	4 (1.1%)	0.037
Outcomes				
Hospital LOS	5 (3 - 10)	7 (3 - 13)	6 (3 - 10.5)	0.019
ICU LOS	5 (3 - 10)	7 (3 - 13)	4 (2 - 9)	0.221
Ventilator days	3 (2 - 7)	7 (3 - 12.5)	4 (2 - 9)	0.084
Mortality	4 (1.5%)	4 (3.8%)	8 (2.2%)	0.167

**IMPACT OF CRASH DYNAMICS ON MORTALITY AND INJURY OUTCOMES AFTER ROAD TRAFFIC CRASHES (RTC) IN INDIA**

Divya Kewalramani, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** RTC are a leading cause of mortality worldwide. While previous studies investigated the epidemiology and risk factors associated with RTC, there is a lack of research examining relationships between vehicle collision mechanics (VCM) and the resulting patterns of occupant injuries. We hypothesize that interrelationships between VCM and occupant injuries will reveal distinct patterns to inform targeted interventions to improve vehicle safety designs and road safety protocols, ultimately reducing RTC mortality.

**Methods:** Forensic investigation data from 149 road crashes was analyzed (169 Light Motor Vehicles (LMVs) and 222 unique events). Crash simulations were generated using PC-Crash and cross-referenced with 39 medical injury reports. Vehicular damage was categorized by magnitude (minor, moderate, or severe) and impact location (front, rear, side, roof). Injuries were classified by nature and severity using the Abbreviated Injury Scale (AIS). Descriptive statistics and correlation analysis quantified the relationships between vehicular damage and occupant injuries.

**Results:** Of 149 crashes, 95 (64%) were fatal and 42 (28%) resulted in serious injuries (AIS greater than 4). Rear-end collisions were the most prevalent (51%), followed by rollover (16%) and off-road object impacts (11%). Impact force was primarily from the front (58%), followed by side planes (24%) and the rear (12%). Passenger compartment intrusion caused 54.4% of fatalities, (longitudinal intrusion=53.6%; vertical and lateral intrusions=36.4%).

Category	Details
Time Period	2019 to 2023
Data Set	149 unique cases, 169 LMV inspections, 222 events with LMV as collision partner
Crash Severity	64% fatal, 28% serious injury
Road Type	93% on expressways, 7% on national highways
Time Zone Distribution	00:00-03:00 (18%), 03:00-06:00 (19%), 06:00-09:00 (19%), 09:00-12:00 (14%), 12:00-15:00 (9%), 15:00-18:00 (8%), 18:00-21:00 (6%), 21:00-24:00 (6%), Unknown (1%)
Lighting Conditions	42% daylight, 35% dark-not-lighted, 10% dawn/dusk, 7% dark-lighted, 6% unknown
Crash Configuration	Rear-end (51%), off-road object impacts (25%), others (24%)
Driving Behavior	Sleepy/fatigued (24%), not in vehicle (7%), attentive (57%)
Vehicle Damage	Rollover (19.5%), fire (0.6%), driveline damage (22%)
Safety Systems	ABS availability (41.4%), Seatbelt availability (81.6%), Seatbelt usage (19%)
Collision Partner	Straight Truck (44%), Pickup/LCV/Minitruck (18%), Bus (23%), Object Impact (13%), Tanker/Tipper/Tractor Trailer (3%)
Most Harmful Configuration	Side/angle impact (36%), rear end (36%), head-on (21%)
Seating Position Analysis	Front row (41%), second row (28%), third row (10%), Injury linked to longitudinal intrusion (77%)
Seatbelt Usage Analysis	Not using seatbelts (56%), Unavailable (15%), Fatality increase with non-usage (65%), Fatalities where available but not used (18%)
MAIS-Body Region Analysis	Head injuries (62% overall, 68% fatal), Thorax injuries (21% overall, 21% fatal), Lower Extremity (5%), Spine (3%), Upper Extremity (3%), Unknown (5%)

Speeding over 80 km/h increased fatality rates to 46%. The safety systems analysis revealed only 41.4% of LMVs had Anti-lock Braking Systems. Only 19% of victims

utilized seatbelts overall and seatbelts were not used or available in 59% of mortalities.

**Conclusion:** The patterns identified in this study provide a foundation for evidence-based strategies to enhance LMV safety designs to improve mortality. These include minimizing passenger compartment intrusion, implementing rollover prevention technologies, while promoting the adoption of safety features like ABS, seatbelts, and speed management strategies.

## **INCREASED RISK OF POST-INJURY PULMONARY EMBOLISM AMONG SICKLE CELL DISEASE PATIENTS**

Ektha Parchuri, MD

Invited Moderator: Milos Buhavac, MD

**Background:** Clinical implications and management of traumatic injury in individuals with sickle cell disease (SCD) and sickle cell trait (SCT) are poorly understood. While recent studies suggest an increased predisposition to post-injury vaso-occlusion, it is unknown whether SCD and SCT patients experience increased rates of adverse outcomes following injury, specifically pulmonary embolism (PE), acute renal failure syndrome (ARFS), deep venous thrombosis (DVT), and rhabdomyolysis.

**Methods:** Retrospective cohort of SCD, SCT, and non-sickle cell control subjects with a history of traumatic injury from 1990 to 2021 was extracted from All of Us Research Program (AoURP) data browser. Through ICD-9/10 codes, the earliest date of a traumatic injury and date of secondary outcomes within 12 months of injury was identified. Demographic, injury, and outcome data was extracted for qualifying patients. T-tests, ANOVA, and Chi-squared tests were used for descriptive statistics. Kaplan-Meier survival analysis captured incidence of outcomes over time. Cox proportional hazard models identified confounders between age at injury, gender, cohorts, and outcomes.

**Results:** SCD (n=335), SCT (n=684), and non-sickle cell controls (n = 102,391) were identified. Females overrepresented males (60.70% vs 36.77%). Mean age was 47 (SD 17); SCD and SCT patients were younger than controls (39 vs 37 vs 47;  $p = 0.01$ ). Patients with SCD – compared to SCT and controls – had significantly higher rates of ARFS (24.77% vs 13.89% vs 10.89%;  $p = 0.01$ ), DVT (6.57% vs 3.07% vs 1.99%;  $p = 0.01$ ), PE (5.67% vs 2.33% vs 1.67%), and rhabdomyolysis (0.89% vs 0.87% vs 0.70%;  $p = 0.01$ ) within 12 months of their injury. Controlling for confounders, SCD patients had a significantly higher risk of ARFS (HR= 1.590,  $p = 0.044$ ) and PE (HR=2.901,  $p = 0.01$ ) than controls and significantly higher risk of PE (HR=3.215,  $p = 0.01$ ) than SCT patients within 12 months of injury. Older age ( $\geq 65$ ) heightened risk of DVT ( $p = 0.045$ ), ARFS ( $p = 0.0193$ ) and PE ( $p = 0.048$ ) across all groups.

**Conclusion:** Patients with SCD are at a significantly higher risk of post-injury pulmonary embolism compared with both SCT and controls. Older age intensifies this susceptibility. Future research may refine risk assessment models for tailored interventions in sickle cell patients following trauma.



**IS WHOLE-BODY CT SCAN WARRANTED IN  
ELDERLY PATIENTS AFTER A FALL?**

Nicholas Gargiulo, MD

Invited Moderator: Milos Buhavac, MD

**Background:** the purpose of this study was to assess the prognostic value of demographic and clinical characteristics and determine which elderly patients will benefit from ct chest and/or abdomen/pelvis (ct cap) during their trauma evaluation.

**Materials and methods:** we conducted a retrospective study of elderly patients  $\geq 65$  years that were evaluated by trauma surgery from january 2016 to december 2020. Patients with low-level fall, defined as fall from standing or sitting position that underwent ct cap as part of their initial evaluation were included. For our statistical analysis we compared patients that were diagnosed with chest and/or abdominal trauma on ct versus patients with no traumatic findings on ct. A p value 0.05 was considered significant.

**Results:** 244 patients met the inclusion criteria. The mean age was 79.6 years and 56.1% were male. The ct was positive in 23.8% of cases. The most common finding was rib fractures (67.2%) followed by spinal fractures (19%). Features that were associated with higher probability of positive ct results were decreased breath sounds (p: 0.02), site-specific pain/tenderness (p .0001) and absence of extremity fractures (p: 0.01). There was no association between positive ct results and gender (p: 0.88), age (p: 0.73), use of antiplatelets (p: 0.63) or anticoagulants (p: 0.7), neurologic deficit (p: 0.67) or abrasions and/or ecchymoses (p: 0.24).

**Conclusion:** a lower threshold for body ct is necessary to avoid missed injuries in the elderly population. More broad and prospective randomized controlled studies are necessary to develop guidelines that could guide our approach to the evaluation of elderly trauma.

## CHALLENGES IN SAVING PATIENTS WITH TRAUMA IN SEOUL: A RETROSPECTIVE COHORT STUDY BASED ON 2016-2020 COMMUNITY-BASED SERVE TRAUMA SURVEY

Hoonsung Park, MD

Invited Moderator: Milos Buhavac, MD

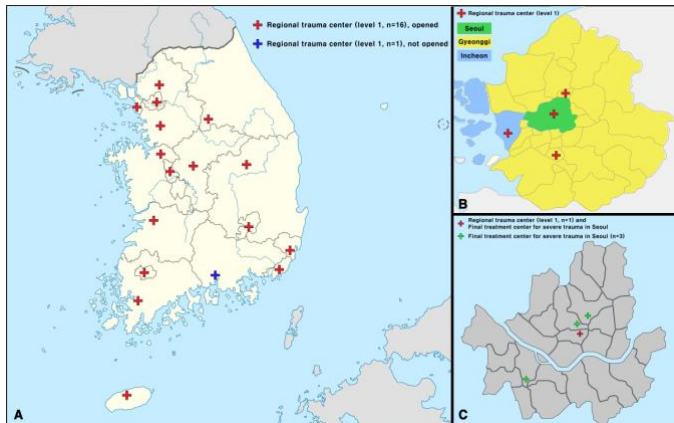
**Objective:** This study aimed to investigate the characteristics and mortality risk factors of patients with trauma in South Korea, focusing on Seoul, which has the highest preventable trauma death rate (PTDR) (20.4%) and Gyeonggi-Incheon, which has the lowest PTDR (13.1%).

**Methods:** This retrospective cohort study used data from the 2016–2020 Community-Based Severe Trauma Survey. Among the 237,616 patients, 24,448 were included in the study after applying the inclusion and exclusion criteria.

**Results:** All variables in patient characteristics differed significantly between Seoul and Gyeonggi-Incheon. No significant difference was observed in the time from 119 calls to the emergency room (ER) visits between the two groups (27.9 min vs. 28.7 min). The time from the ER visit to the first transfusion was significantly shorter in Gyeonggi-Incheon (232 min vs. 154 min). In Seoul, the identified risk factors included age (aOR 1.03, 95% CI, 1.03–1.04, p.0001), regarding insurance type (reference = National Health Insurance), loss of NHI (aOR 2.6, 95% CI, 1.81–3.73, p.0001), others (aOR 2.35, 95% CI, 1.46–3.76, p.0001), ISS (aOR 1.11, 95% CI, 1.1–1.12, p.0.001), regarding trauma severity (reference = ISS≤15), ISS>15 (aOR 2.26, 95% CI, 1.73–2.94, p.0001), regarding hospital level (reference = regional trauma centers), regional emergency centers (aOR 2.62, 95% CI, 1.14–6, p=0.023), local emergency centers/institutes (aOR 2.33, 95% CI, 1.03–5.31, p=0.043), number of angioembolizations (aOR 1.4, 95% CI, 1.06–2.1, p=0.021). In Gyeonggi-Incheon, the identified risk factors included age (aOR 1.03, 95% CI, 1.02–1.04, p.0001), Loss of NHI (aOR 1.88, 95% CI, 1.18–2.99, p=0.008), ISS (aOR 1.06, 95% CI, 1.04–1.08, p.0001), regarding Trauma severity (reference = ISS≤15), ISS>15 (aOR 5.69, 95% CI, 3.94–8.21, p.0001), regarding mechanism (reference = Car Traffic Accident), falls and slippages (aOR 1.83, 95% CI, 1.27–2.63, p.0001).

**Conclusion:** No

differences were observed between the two groups in terms of patient characteristics or time required for major procedures. However, the time from the ER visit to the first blood transfusion was shorter in Gyeonggi-Incheon. The unique mortality risk factors for Seoul compared with Gyeonggi-Incheon were regional emergency centers, local emergency centers/institutes, and angioembolization.



## **COMPARISON OF SURVIVAL OUTCOMES IN TRAUMA PATIENTS TREATED WITH ECMO OVER THE YEARS**

Oswald Perkins, MD

Invited Moderator: Milos Buhavac, MD

**Background:** Despite an overall increase in the use of Extracorporeal Membrane Oxygenation (ECMO), there is a paucity of data regarding how ECMO outcomes have changed in recent years. We evaluated the use of ECMO in the trauma population in a nationwide sample between 2017-2021 to determine if outcomes improved as levels of comfort and knowledge increase in this population. We utilized the most up to date national cohort of this population. We hypothesize that outcomes have improved due to increased familiarity with use of ECMO in trauma.

**Methods:** The 2017-2021 Trauma Quality and Improvement Program (TQIP) database was queried for patients  $\geq 18$  years of age treated with veno-venous (VV) and veno-arterial (VA) ECMO. The primary outcome was survival to discharge. Secondary outcomes included length of stay (LOS), intensive care unit LOS, and ventilator days.

**Results:** 1232 trauma patients received ECMO between 2017-2021 with 225, 253, 265, 274, 215, cases each year respectively. Most patients were male (81%) who sustained blunt injuries (73.3%). The average age was 34 [interquartile range 21-45], mean injury severity score was 28.4 [17-38], and prehospital cardiac arrest was found in 9.1% of patients. When comparing outcomes by year across the study period, there were no differences in 30-day mortality (32%,  $p=0.479$ ) or hospital mortality (36%,  $p=0.27$ ). There were also no statistical differences in ICU LOS (median 19 days [8-32]), total LOS (median 25d [9-41]), or total ventilator days (median 14d [6-27.5]) ( $p$  value  $> 0.1$  for all).

**Conclusion:** The use and outcomes of ECMO in the trauma population have remained stable in recent years. Recent studies have suggested safety and outcome benefit in trauma which may reflect potential for increased use to broaden benefit in this population. Further research is needed to assess its safety and effectiveness as ECMO use expands to new populations.

**THE EXTERNAL VALIDATION OF THE REVISED  
LETHAL TRIAD CRITERIA FOR APPROPRIATE  
STRATEGIC DECISION-MAKING**

Keisuke Suzuki, MD

Invited Moderator: Milos Buhavac, MD

**Background:** It was pointed out that the conventional lethal triad criteria in trauma was too specific for death and was therefore inappropriate as a standard for strategic decisions. We previously proposed the revised lethal triad criteria based on the data multicenter observational study, in which positive is defined as meeting one major criterion (fibrin/fibrinogen degradation product [FDP]  $>90 \mu\text{g/ml}$ ) or two minor criteria (base excess [BE]  $-3 \text{ mEq/L}$  or temperature  $36^\circ\text{C}$ ). The present study aimed to externally validate this revised lethal triad criteria for the usefulness as the indicator for damage control strategy in severe blunt trauma patients.

**Methods:** Trauma patients injured by blunt mechanism with an Injury Severity Score  $\geq 16$  and admitted to 25 institutions in Japan between April 2018 and March 2019 were included. The predictive accuracy of the conventional and revised lethal triad criteria was evaluated using the area under the receiver operating characteristic curve (AUC). Calibration plots were used to visually evaluate the agreement between predicted and observed mortality.

**Results:** A total of 1177 severe blunt trauma patients were evaluated, of which 125 patients (10.6%) died during hospitalization. While the conventional criteria predicted outcomes with a sensitivity of 2.8% and specificity of 99.8%, the revised criteria predicted outcomes with a sensitivity of 80.6% and specificity of 64.4%. The area under the characteristic curves for conventional criteria and revised criteria was 0.662 and 0.765, respectively.

**Conclusion:** The revised lethal triad criteria demonstrated reasonable sensitivity and specificity as the standard for the decision making of therapeutic strategy in severe blunt trauma patients. The criteria for decision-making in penetrating trauma should be further assessed.

## REFINING RISK IN RIB FRACTURES: THE COMPOUND EFFECT OF RIB FRACTURE SEVERITY AND AGE IN PREDICTING MORTALITY

Arnav Mahajan, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** Older patients with multiple rib fractures are at a high risk for morbidity and mortality. Current clinical scoring systems often treat age as an independent factor without considering its relationship to other factors. This approach may lead to unwieldy rib fracture scoring systems. We examined the interplay between age and fracture severity to propose a refined understanding of this relationship to yield simpler yet effective clinical tools.

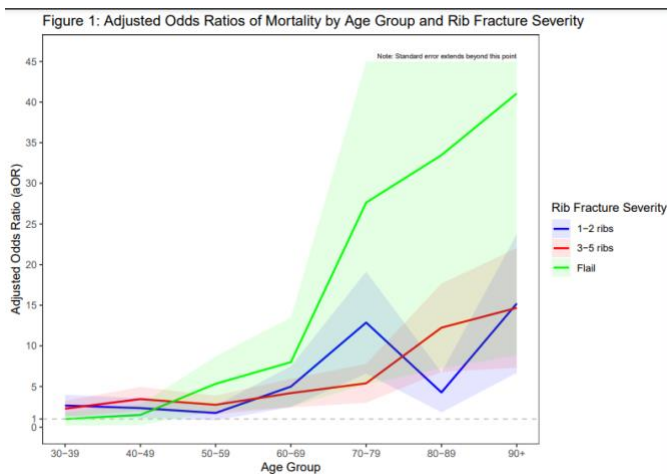
**Methods:** In this single-center retrospective study, we reviewed our trauma patient registry from January 2012 to December 2023. We included all adults with blunt trauma and rib fractures, categorized as 1-2 ribs fractured, 3-5 ribs fractured, or flail chest. We collected information on demographics, comorbidities and Glasgow Coma Scale score at admission. Adjusted logistic regression using an interaction variable between deciles of age and rib fracture severity was used to identify factors associated with mortality, reported as adjusted odds ratios (aOR).

**Results:** We analyzed 4,843 patients with blunt rib fractures. Median age was 56 years (IQR: 40.5 – 70) and 63.3% had 3-5 ribs fractured. Overall mortality was 8.6%. Adjusted for other factors, age and rib fracture severity are significant predictors of mortality risk for all age deciles. Flail chest predicts significant mortality risk for ages above 50. We found a non-linear relationship of mortality between rib fracture severity and age, with significant variation in

cohorts below the age of 60. Patients aged 70-79 with 1-2 rib fractures (aOR: 12.7) exhibited higher mortality odds compared to patients in the same age group with 3-5 rib fractures (aOR: 5.4). This pattern reversed in the

80-89 age cohort, where having 3-5 rib fractures (aOR: 12.2) contributed higher mortality odds than patients in the same age group with 1-2 rib fractures (aOR: 4.3). [Figure 1].

**Discussion:** The interplay of age and rib fracture severity is complex, and mortality risk is non-linear across different age deciles. Despite this, age and rib fracture severity alone effectively predict patient mortality. Simplifying risk assessment tools to incorporate this relationship could significantly improve mortality risk predictions for clinical application.



## MANAGEMENT AND OUTCOME OF VARIOUS TYPES OF NECK INJURIES AT LEVEL 1 TRAUMA CENTRE- AN AMBISPECTIVE OBSERVATIONAL STUDY

Sandeep Tiwari, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** Neck injuries are challenging for Trauma services and present as acute emergency. These injuries are due to accidents, suicides, homicides and animal injuries both as blunt and penetrating injuries. Behavioral changes in the society has given rise to increased number of suicides & homicides In North India, Manjha injuries are specific.

**Methodology:** The study was ambispective observational study with 390 patients admitted in department of trauma surgery after sustaining various type of neck injuries over a period of 7 years at level 1 trauma centre. Epidemiological parameter, mechanism of injuries, management and outcome were noted

**RESULT:** In total 390 patients, majority of patients were male 332 and female 58. Age group was (21-30), mean age was 28.68. In mechanism of injury homicidal cases 188 included 78 of firearm, 35 by sharp object, 21 of stab injury and 54 were blunt trauma. Of

total 121 accidental cases, 70 had history of RTA, 18 were injured by kite thread (MANJHA injury), 9 were of blast injury, 24 cases by fall on sharp object. 54 cases with suicidal attempt, 19 cases were due to animal involvement and 8 miscellaneous causes.



Site of injury were isolated neck injuries 343, neck injury with chest injuries 22, with head injuries 12, with abdominal injuries were 13. Penetrating injuries were more common (86.1%). Management includes primary repair and closure (186), conservative (71), surgical repair with management of associated injuries (26), tracheal repair with distal tracheostomy (89), wound exploration (13), vessel ligation(5). In outcome of total 390 patients, 313 were discharged, 19 required ICU care and ventilation, 13 expired, 20 were treated for various complications, 25 were transferred to speciality department for further management.

**Conclusion:** Neck injuries are life threatening injuries but timely intervention can save many lives. Management of the patient depends on the presentation. Airway is foremost priority. The simple and small looking injury may be so serious that it should be considered life threatening and thorough evaluation and management should be done.

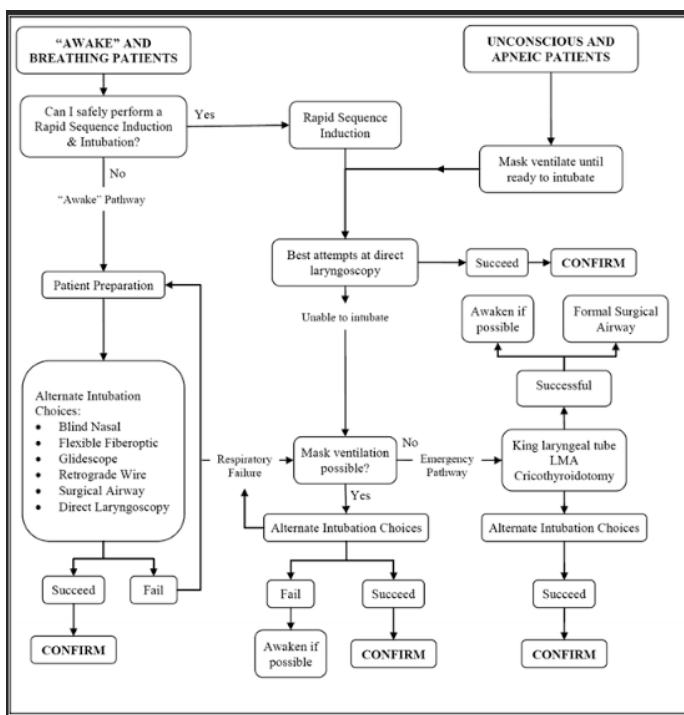
## PREHOSPITAL AIRWAY MANAGEMENT IN COMBAT TRAUMA: CURRENT EVIDENCE

Vikas Chawla, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** Airway management is of critical importance in combat trauma patients. Airway management failures account for 8 to 15% of potentially preventable trauma deaths. Airway obstruction is the second most common cause of potentially survivable death in combat, accounting for about 1 in 10 preventable deaths. The prehospital setting represents the area of most significant difference in planning and practice between the civilian and combat trauma systems. Prehospital airway management

aims to maintain oxygenation and ventilation rather than establish a definitive airway in adults. Combat medics can perform several prehospital lifesaving interventions to manage casualty airways, including



cricothyrotomy, bag-valve-mask (BVM) ventilation, and supraglottic airway (SGA) placement.

**Summary:** Airway compromise remains a leading cause of death in battlefield trauma. In patients with traumatic injuries, the timing and selection of airway interventions must be balanced with the need to optimize hemodynamic resuscitation and transport the patient promptly to a designated facility for definitive care.

# **PREDICTORS OF OUTCOMES OF MOTORCYCLE CRASH ISOLATED HEAD INJURIES FROM A TERTIARY GOVERNMENT HOSPITAL IN THE PHILIPPINES**

Delbrynth Smigel, Emmea June Quidbod, MD

Invited Moderator: Milos Buhavac, MD

In the Philippines, there continues to be a lack of reliable public transportation options, which contributes to the increasing number of motorcycles registered. Despite legislation regarding helmet use and speed limit, motorcycle crash (MCC) remains to be the most common trauma mechanism that ends up in hospital admission. This study was designed to evaluate and compare the outcomes among helmeted and non-helmeted patients who sustained isolated MCC-related head injuries in our institution.

This was a retrospective observational cohort study of all patients admitted with isolated traumatic brain injuries (TBI) due to MCC from January 1, 2018 to December 31, 2022. There were 350 patients identified with blunt TBI during the study period, of which 98 (28.0%) patients had isolated TBI due to MCC. Patients had a median age of 31.5 years, were predominantly males (77.6%) and were non-helmeted (70.0%).

Non-helmeted patients were most likely alcohol-intoxicated (48.0% vs 10.2%,  $p=0.003$ ), had depressed GCS score (9 vs 14,  $p<0.001$ ), and had severe TBI (59.2% vs 5.1%,  $p<0.001$ ) on admission. Moreover, non-helmeted patients were most likely managed surgically (66.3% vs. 21.4%,  $p<0.001$ ), were found to have greater hospital length of stay (11.5 vs 7.0 days,  $p=0.045$ ), with increased need for intensive care unit admission (59.2% vs 10.2%,  $p<0.001$ ), with increased need for mechanical ventilator (57.1% vs 11.2%,  $p<0.001$ ), had more complications (25.5% vs 3.1%,  $p=0.013$ ), and had higher overall mortality (18.4% vs 0,  $p=0.001$ ). Helmet use had been significantly protective against severe TBI (OR 0.030, 95% CI 0.007–0.122,  $p<0.001$ ).

Hence, a more rigorous enforcement of existing traffic laws, as well as a more effective education campaign about the positive impact of helmet use, is imperative to reduce the rates and the debilitating outcomes of severe TBI in the country.

## **Logistic regression analysis for severe TBI**

Parameters	p-value	OR	95% CI	
Age > 65 years	0.322	0.226	0.012	4.286
Male	0.938	0.946	0.233	3.842
Alcohol	0.320	0.486	0.117	2.012
<b>Helmeted</b>	<b>&lt;0.001</b>	<b>0.067</b>	<b>0.016</b>	<b>0.279</b>

*Test for collinearity was performed prior to analysis. AUROC 0.907 (95% CI 0.850-0.965). OR, odds ratio. CI, confidence interval.*



# FACTORS ASSOCIATED WITH IN-HOSPITAL MORTALITY AMONG PREGNANT TRAUMA PATIENTS; A NATIONWIDE STUDY IN JAPAN

Lisa Marie Knowlton, MD

Invited Moderator: Milos Buhavac, MD

**Introduction:** Trauma is the leading non-obstetric cause of maternal death during pregnancy, accounting for over 5% of deaths despite advancements in management. Identifying risk factors and optimizing in-hospital management are essential for improving outcomes. In this study, we assessed factors associated with mortality of pregnant trauma patients.

**Methods:** We conducted a retrospective analysis of the Japan Trauma Databank (JTDB), evaluating data from January 2004 to May 2019. Participants included pregnant women aged 15-49 across all gestational ages who experienced trauma with at least one injury of an Abbreviated Injury Scale (AIS) score of 3 or higher. Patient demographics, in-hospital management strategies, and outcomes, primarily in-hospital mortality and length of hospitalization were first described. Multivariable logistic regression was performed to assess independent parameters associated with in-hospital mortality: age, systolic blood pressure, injury severity score (ISS), presence of abdominal injury, decision to perform computer tomography (CT), and surgery.

**Results:** Of 361,706 trauma patients, a total of 165 (0.05%) pregnant trauma patients were identified. The predominant injury type was blunt (94.5%), primarily due to vehicular collisions (58.2%). Head injuries were most common (33.3%). Diagnostic interventions included CT scans (62.4%), with head CTs accounting for 87.4% of these. Angiography was utilized in 3.6% of patients, half of which were abdominal. Surgical procedures were performed in 27.9% of cases, predominantly orthopedic (69.6%). Use of FAST ultrasound was notable at 84.8%. The in-hospital mortality rate stood at 6.1%, with an average hospital stay of 7 days. In the multivariable analysis, the decision to perform CT yielded the adjusted odds ratio (AOR) of 0.066, with a 95%

confidence interval

(CI) of 0.003-1.376. ISS was the only factor associated with in-hospital mortality (AOR 1.198 [95% CI 1.071-1.340]).

**Conclusion:** In this nationwide Japanese study, a high mortality rate was observed in the pregnant trauma population. This may be due to the difficulty in the multidisciplinary management of the fetus and the mother. In multivariable logistic regression, the decision to perform CT was associated with reduced mortality. The findings highlight the importance of conducting CT scans even in pregnant trauma patients.

**Table 1 Factors Associated with In-Hospital Mortality of Pregnant Trauma Patients**

Variables	Mortality % (n/N)	Adjusted OR (95% CI)	P value
Age (years)	6.1 (10/165)	1.128 (0.953-1.335)	0.16
Systolic BP			
≤ 90 mmHg	38.9 (7/18)	5.725 (0.544-60.211)	0.146
> 90 mmHg	2.1 (3/145)	Reference	
Missing	0.0 (0/2)		
ISS	6.1 (10/165)	1.198 (1.071-1.340)	0.002
Abdominal injury			
(+)	18.8 (3/16)	0.712 (0.037-13.677)	0.822
(-)	5.2 (7/135)	Reference	
Missing	0.0 (0/14)		
Performed CT scan			
(+)	6.8 (7/103)	0.066 (0.003-1.376)	0.079
(-)	3.4 (3/62)	Reference	
Performed surgery			
(+)	8.7 (4/46)	0.887 (0.051-15.467)	0.934
(-)	5.0 (6/119)	Reference	

OR, Odds Ratio; CI, Confidence Interval; BP, Blood Pressure; ISS, Injury Severity Score; CT, Computer Tomography

**EXPLORING THE IMPACT OF AI ALGORITHMS ON  
PHYSICIAN PERFORMANCE IN PELVIC RADIOGRAPHY:  
A PROSPECTIVE, OBSERVER-BLINDED USER TEST  
STUDY**

Szu An Chen, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Background:** Hip and pelvic fractures are common emergencies globally, associated with high mortality and morbidity rates. Despite relying on plain pelvic X-rays (PXR) for diagnosis, miss rates remain high, necessitating improved methods. Artificial intelligence (AI), particularly deep learning algorithms, holds promise in enhancing diagnostic accuracy. However, the practical impact of AI on clinical practice and its interaction with physicians remain underexplored.

**Methods:** 26 physicians (8 radiologists, 10 emergency physicians, and 10 trauma surgeons) participated in a prospective study at Linkou Chang Gung Memorial Hospital. We developed a deep convolutional neural network (DCNN) algorithm for PXR analysis. Physicians assessed PXRs without AI assistance initially, followed by AI-supported assessments. The AI system provided varying information levels. We recorded and analyzed physicians' performance, time efficiency, and confidence levels during PXR interpretation.

**Results:** Physicians' performances significantly improved with AI. There was an 8.0% increase in accuracy, 11.5% in specificity, 21.3% in positive predictive values (PPV), and a 10.2% in F1-score (all p value less than 0.05). Surgeons and emergency physicians saw substantial improvements in specificity, PPV, and F-1 scores (p value less than 0.05). Reading time reduced significantly (from 22.7s to 9.6 sec/PXR, p value less than 0.001), and confidence levels improved with AI assistance.

**Conclusion:** AI, specifically DCNNs, enhances PXR interpretation. Tailored AI tools can bridge the gap between radiologists and non-radiologists, improving diagnostic accuracy and patient care. Integrating AI into clinical practice optimizes efficiency in diverse healthcare settings.

**TARGETED MUSCLE REINNERVATION (TMR) AT THE TIME OF MAJOR LIMB AMPUTATION IN PATIENTS WITH LOWER EXTREMITY TRAUMA. A RANDOMIZED CONTROL TRIAL**

Abhinav Kumar, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** Post-amputation pain in amputees is a major cause of morbidity. Recent studies have highlighted the impact of pre-emptive surgical intervention of the amputated nerves for the prevention and treatment of post-amputation pain. In this study we aimed to analyze the role of Targeted muscle reinnervation (TMR) at the time of limb loss in addressing both residual limb pain and phantom limb pain.

**Methodology:** In this open RCT, patients with lower extremity trauma undergoing above-knee amputation were randomized into two groups ie group A with TMR (Intervention) and group B with conventional stump formation (Control) at the time of amputation using simple mixed block randomization. The primary outcome analysis for the assessment of postoperative residual limb pain (RLP) and phantom limb pain (PLP) at five-time points postoperatively viz. 48 hours, 2, 4, 8, and 12 weeks were done using the Numerical Rating Scale (NRS) for RLP and PLP, the HADS, the McGill questionnaire, and PROMIS scores.

**RESULTS:** The majority of the patients were males (n=37:92.5%). The mean MESS score was comparable (p=0.98). The mean NRS of RLP at the end of 12 weeks was 1.6 in the intervention arm and 3.2 in the control (p-value of 0.001). While the mean NRS of PLP at the end of 12 weeks was 0.9 in the intervention arm and 3.1 in the control (p-value of 0.001).

**Conclusion:** The preemptive surgical intervention of amputated nerve at the time of amputation by TMR techniques significantly reduces the postoperative residual limb pain and phantom limb pain.

**Keywords:** TMR; Targeted Muscle Reinnervation; Residual limb pain; Phantom limb pain; Above-knee amputation.

**IMPACT OF PSYCHOLOGICAL INTERVENTION ON  
QUALITY OF LIFE IN PATIENTS WITH POST-  
TRAUMATIC LIMB AMPUTATION/S – A RANDOMIZED  
CONTROLLED TRIAL**

Kaur Milandeep, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** Post- traumatic amputations engender a tumultuous array of emotions for the individual affected which ranges from general anxiety disorders to depression and can even lead to self harm. These amputations are abrupt in nature and hence impart and heightened psychological impact on patients compared to amputations stemming from other medical reasons. Hence, study was designed to evaluate the effect of brief psychosocial intervention on Quality of Life of post traumatic amputees.

**Material and Methods:** This was a randomized control study. Patients >18 years of age, well oriented and coherent, with social support and with no prior history of psychological illness who underwent post traumatic extremity amputation/s were recruited. Baseline questionnaires for psychological assessment were filled as soon as possible after the surgery with informed consent. These patients were randomized (n=74), and conventional care was given to Group A (n=39) and psychosocial intervention along with conventional care was given to Group B (n=35) for 7 weeks. Patients of both the groups were asked to fill the same questionnaire after 8 weeks post first assessment.

**Results:** A total of 74 patients with post- traumatic amputation/s were enrolled in the study. Mean age of cohort was 32.8 years with male predominance (n=70). RTI was the most common mechanism of injury. All the 4 domains (physical health, psychological health, social relationship, environment domain), WHO total and Overall quality of life showed significant improvement in both the groups. However, there was no significant difference between the groups. Depression was significantly decreased in both the groups in 8 weeks but there was no significant difference between two groups (p=0.101). Same trend was observed with anxiety and stress. However, body image showed a significant improvement in Group B as compared to Group A (p= 0.023).

**Conclusion:** Our study did not show any observable positive effects of psychosocial intervention over conventional care on quality of life, depression, stress or anxiety except on body image. We hypothesize that positive results might be observed in quality of life of amputees if a larger study with longer duration of psychosocial intervention is conducted.

WITHDRAWN

**SAFETY OR SPEED? ASSESSING ALTERNATIVE  
VASCULAR ACCESS FOR ANGIOGRAPHY FOLLOWING  
RESUSCITATIVE ENDOVASCULAR BALLOON  
OCCLUSION OF THE AORTA (REBOA) IN SEVERE  
PELVIC TRAUMA PATIENTS**

Yauren Chang, MD

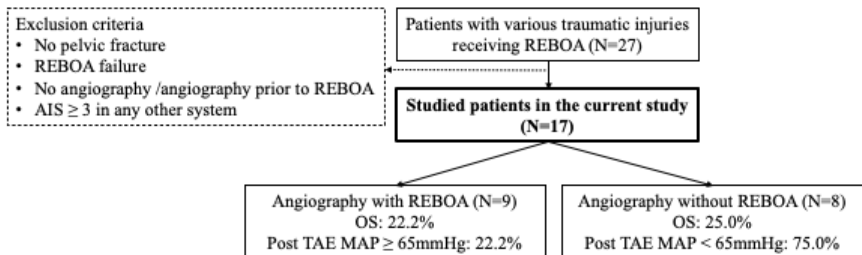
Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a technique gaining traction for hemorrhage control in severe pelvic fractures. The success of subsequent transcatheter arterial embolization (TAE), a mainstay for managing hemorrhage, often hinges on overcoming the challenges of vascular access post-REBOA. Our study focuses on these challenges and their impact on patient outcomes in the context of severe pelvic trauma.

**Methods:** We performed a retrospective review of pelvic fracture cases at our institution from 2017 to 2023, selecting patients who underwent both REBOA and TAE. We excluded those with high Abbreviated Injury Scores in non-pelvic regions, or where REBOA placement was suboptimal. Data collected included demographics, injury patterns, procedure details, complications, and survival rates, with a focus on the duration of REBOA inflation and angiographic cannulation times.

**Results:** In our study, 17 patients met the inclusion criteria. The majority were male (76.5%) with a median age of 51. Overall survival was 23.5%. Patients were grouped into angiography with or without REBOA. Angiography without REBOA group was younger (39.0 vs. 63.0,  $p = 0.030$ ), and had higher shock index at triage (2.30 vs. 1.10,  $p = 0.015$ ). More patient whose post TAE mean arterial pressure (MAP)  $\geq 65$ mmHg was found in angiography without REBOA group (75.0% vs. 22.2%,  $p = 0.044$ ), though no significant difference on Overall survival (25.0% vs. 22.2%,  $p = 1.000$ ). Angiographic cannulation times, pre-angiographic MAP, and amount of pre-angiographic transfusion of Packed RBC, were similar across groups.

**Conclusion:** Our findings provide empirical insights into vascular access selection and suggest that angiography without REBOA in the management of severe pelvic fractures can be beneficial, particularly when pre-angiographic resuscitation is sufficient. Larger studies are required to validate these observations and assess long-term outcomes.



## **RISK FACTORS FOR AMPUTATION OF AFFECTED LIMB IN COMPLEX EXTREMITY INJURY**

Ryosuke Omoto, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** In severe open fractures of the extremities, the decision to amputate the affected limb is not an easy one. Various scoring systems have been reported for severity evaluation, but there is no consensus and no clear criteria. Therefore, in the present study, we respectively aimed to investigate the feasibility of Mangled Extremity Severity Score (MESS) in deciding amputation of the affected limb.

**Method:** Of 287 open extremity fracture cases admitted to our facility between 2013 to 2024, 56 cases of classified as IIIB or IIIC by Gustilo-Anderson classification were divided into two groups: amputation and preservation. The MESS was compared retrospectively, and cases with a MESS score of less than 7 points that resulted in amputation of the affected limb and cases with a MESS score of more than 7 points that resulted in preservation of the affected limb were additionally examined.

**Result:** In our cases, amputation group was 18, and preservation was 38 cases. The sensitivity and specificity of MESS were 83.3% (15/18) and 89.4% (34/38), respectively. MESS (Amputation vs preservation: 8 [7-9] vs 6 [5-6];  $P=0.001$ ) was significantly higher in Amputation group than in preservation group. There were three cases in which the MESS was less than 7 but required amputation. None of these cases required amputation at the initial surgery. One case was amputated due to wound infection, and two cases resulted in amputation due to severe damage to the joint ligaments. On the other hand, four cases with MESS scores of 7 or higher were spared amputation. One of them was a Gustilo classification IIIC open tibiofibular fracture with complete occlusion of the popliteal artery at MESS:9, but the leg could be saved because of the revascularization.

**Conclusion:** At our institutions, MESS in open extremity fractures was shown to be a useful predictor of amputation of the affected limb. Patients with open fractures complicated by severe wound infection or severely contused joint ligament injuries may require amputation even with low MESS, whereas patients with good revascularization may be preserved even with high MESS.

**TENSION BAND FIXATION FOR PATELLAR  
FRACTURES: A STUDY OF FAILURE FACTORS**

Hiroakil Iwase, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Background:** The gold standard of treatment for patellar fractures is tension band fixation, but reoperation is often required in cases of fixation failure. To date, there have been no reports examining the factors that contribute to the failure of tension band fixation for patellar fractures.

**Objective:** To clarify the factors that cause the failure of tension band fixation for patellar fractures.

**Study Design:** Case-Subject Study

**Setting:** Single-center, retrospective study

**Subject:** Patellar fracture cases treated at our institution between January 2008 and October 2023 with fracture type AO classification C1.1, C1.2, C1.3, or C2 and fixed with one tension band. The cases were divided into two groups according to the presence or absence of tension band fixation failure and were designated as case group and subject group.

**Factors:** Factors affecting the failure of tension band fixation were examined retrospectively.

**Primary Outcome:** Age, gender, BMI, fracture type, number of days to start range-of-motion training, whether the hook at the end of the K-wire was driven into the bone, and the distance between the soft wire and the patella were investigated to determine the factors that affected the fixation failure. The distance between the softwire and the patella was measured radiographically at the point where the softwire contacted the K-wire, and the distance was the sum of the four values at the top, bottom, left, and right. The effects of these factors on fixation failure were investigated in univariate and multivariate analyses.

**Results:** Age and the distance between the softwire and the patella influenced Tension band fixation failure, and ROC analysis showed that a distance of 8.15 mm or more between the softwire and the patella was the cutoff value for fixation failure.

**Conclusion:** In tension band fixation of patellar fractures, a distance of 8.15 mm or more between the soft wire and the patella is a risk for fixation failure.



**DOES THE SURGEON'S EXPERIENCE INFLUENCE THE  
DURATION OF SURGERY IN 3D-ASSISTED  
PERCUTANEOUS TRANSPEDICULAR SPINAL  
STABILIZATION? – A RETROSPECTIVE MONOCENTRIC  
ANALYSIS OF 34 PATIENTS AFTER NAVI**

Orkun Ozkurtul, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** The superiority of 3D-navigated dorsal instrumentation over percutaneous transpedicular screw placement has been substantiated in several studies regarding reduced radiation exposure and the safe positioning of pedicular screws. However, the duration of the operation appears to be significantly extended in routine practice due to the additional requirements for special positioning and referencing of the navigation system. The objective of our study was to determine if and how the learning curve of the surgeon can yield improvements in operation duration.

**Methods:** This study was designed as a retrospective monocentric cohort study and analyzes the 3D-navigated transpedicular spinal screw placements conducted at a supraregional trauma center from January 1, 2023, to December 5, 2023. Patients who were primarily operated with navigation using the Loop-x system (Brainlab) were included. The procedures conducted by three surgeons were analyzed. Demographic data, number of screws, operation duration, and the level of spinal injuries were recorded.

**Results and Conclusion:** In the aforementioned period, navigated transpedicular spinal screw placements were performed on 34 patients (47% male, 53% female) with an average age of  $73 \pm 12$  years. Segmental allocation involved 10 (29%) placements at the cervical spine level, thoracic spine was addressed in 11 (32%) cases, lumbar spine in 7 (21%) cases, and the sacrum was instrumented in 6 cases (18%). The average operation time was  $162 \pm 87$  minutes, with the mean time per screw being  $28 \pm 12$  minutes. Surgeon A, with the most navigated procedures totaling 27 (88.2%) cases, had an average screw time of  $22 \pm 12$  minutes (median 24 minutes, range 10-66 minutes), Surgeon B with 3 (9%) cases at  $35 \pm 11$  minutes (median 37.5, range 23-45 minutes), and Surgeon C with 4 cases (12%) and a screw time of  $38 \pm 8$  minutes (median 37, range 30-49 minutes). Regression analysis, due to the small number of cases, did not show a significant relationship between the frequency of operations and duration. Nonetheless, a marked reduction in operation times for screw placement was observed in the surgeon with the highest number of procedures over the period. The standardized and regular performance of the procedure thus enables faster screw placement, thereby increasing the acceptance among surgeons and operating room staff, and facilitating the implementation of navigation benefits considering the limited operating room resources.

## **BINDING BLINDLY: PELVIC BINDERS – A FRIEND OR FOE**

Maximilian Forssten, Shahin Mohseni, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Background:** Pelvic binders are used frequently in prehospital settings for early stabilization when pelvic fractures are suspected. Although a rapid and cost-effective tool, uncertainties persist regarding the safety of this intervention.

**Methods:** A retrospective review of adult patients with a pelvic fracture requiring trauma team activation admitted to a tertiary trauma center between 2020-2023 was conducted. The radiological studies were reviewed by four consultant orthopedic surgeons and were classified according to if the application of a pelvic binder would be potentially beneficial (i.e. stabilize fracture and/or reduce ongoing hemorrhage), make no difference, or be potentially harmful (i.e. further dislocate the fracture, risk exacerbating ongoing hemorrhage, and/or cause additional injuries) to the patient. This classification was based on the pelvic ring fracture pattern, presence of concomitant acetabular and proximal femoral fractures, as well as the consultants' clinical judgement.

**Results:** A total of 298 patients were included in the current investigation. Of these patients, applying a pelvic binder would have been potentially beneficial in 17% of cases (95% CI: 13%-22%, N = 50), make no difference in 28% of cases (95% CI: 23%-33%, N = 82), and be potentially harmful in 56% of cases (95% CI: 50%-61%, N = 166). Out of a total of 10 patients who were hypotensive on admission, applying a pelvic binder would have been potentially beneficial in three cases, constituting 6% of all beneficial cases.

**Conclusion:** The judicious application of pelvic binders, following radiological confirmation of fracture type and severity, is recommended. Routine use in the prehospital and emergency department should be discouraged.

**MULTIFACETED CHALLENGES IN IATROGENIC  
VASCULAR TRAUMA: A CASE FROM THE  
DEPARTMENT OF TRAUMA SURGERY, AIIMS PATNA**

Abdul Vakil Khan, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Abstract:** This case series highlights unique challenges encountered in the management of vascular trauma within the trauma surgery department at AIIMS Patna. Three cases involving arterial injuries with varying etiologies were successfully treated through a combination of prompt surgical intervention and meticulous postoperative care.

**\*\*Case 1:** Iatrogenic femoral artery injury during fracture management \*\*

A 22-year-old male presented with a history of right lower limb injury from a fodder cutting machine. Initial management at a private hospital involved femur and tibia fracture fixation, but intraoperatively, torrential hemorrhage led to femoral pedicle ligation. Referred to AIIMS Patna, the patient underwent thrombectomy, distal fasciotomy, and limb salvage. Successful perfusion restoration resulted in discharge on postoperative day 15.

**\*\*Case 2:** Iatrogenic Femoral Artery Injury during Varicose Vein Surgery\*\*

A 30-year-old male experienced iatrogenic femoral artery injury during varicose vein surgery, leading to absent pulses in the left limb. Urgent intervention at AIIMS Patna involved femoral artery thrombectomy and end-to-end anastomosis. Gradual improvement in limb perfusion in the postoperative period resulted in discharge by day 10.

**\*\*Case 3:** Iatrogenic femoral artery injury after fasciotomy for

Compartment syndrome\*\* A 32-year-old male presented with compartment syndrome secondary to a heavy gate fall, complicated by femoral pedicle transection during fasciotomy at a private hospital. AIIMS Patna intervention included thrombectomy and end-to-end anastomosis, leading to improved limb perfusion by postoperative day 1 and discharge on day 15.

**Discussion & Conclusion:** These cases underscore the diverse scenarios and successful outcomes achieved through the collaborative efforts of the trauma surgery team at AIIMS Patna. The series emphasizes the importance of timely recognition, thorough surgical management, and vigilant postoperative care in achieving positive outcomes in vascular trauma cases.

# **EXAMINING DISPARITIES IN LOWER EXTREMITY VASCULAR TRAUMA – A 12-YEAR SINGLE CENTER RETROSPECTIVE ANALYSIS**

Lubna Khan, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** Lower extremity vascular trauma (LEVT) presents a significant challenge in trauma care, often resulting from both blunt and penetrating mechanisms. It is a devastating injury that can lead to limb loss, with amputation rates ranging from 4% to 21%, along with profound disability and mortality rates as high as 1.5% to 4.5%. Our study aims to define the geographic origins of vascular trauma patients in Houston, analyze their socioeconomic status, and investigate outcomes based on injury patterns in order to identify at-risk groups and develop tailored support programs.

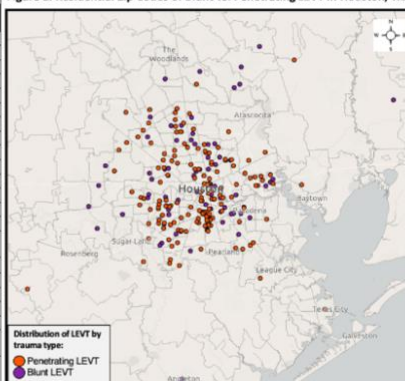
**Methods:** A retrospective analysis of trauma registry data was conducted to compare injury patterns, demographics including race and insurance status, and outcomes among adult patients (age >15 years) with lower extremity vascular trauma between January 2011 to December 2022. Descriptive statistics, Wilcoxon rank sum, Pearson's Chi-squared, and Fisher's exact tests were employed to assess differences and associations. Residential zip codes of patients were extracted and mapped using ArcGIS software. The USZipCode 2022 registry was used for median household income analysis. **Results:** Among the 277 patients with LEVT (Table 1), penetrating LEVT cases (68.6%, n=190) outnumbered blunt LEVT cases (31.4%, n=87). The majority of patients with LEVT were Black/African American (48%, n=132) and Hispanic/Latino (39%, n=109). Patients with blunt LEVT were significantly more likely to undergo amputation (49% in blunt, 2.6% in penetrating; p<0.001), have associated fractures (70% in blunt, 36% in penetrating; p<0.001), and be uninsured (17% in blunt, 38% in penetrating; p=0.004). The mortality rate during index hospitalization did not significantly differ between the two LEVT groups (13% in blunt vs. 19% in penetrating, p = 0.22). There were no notable variations in the regional distribution of LEVT incidents across Houston, TX (Figure 1).

**Conclusion:** In summary, prevalence of LEVT is notably higher among Black and Hispanic populations. Blunt LEVT cases are associated with a higher incidence of amputation and uninsured status, which can potentially hinder access to prosthetics for these patients. These findings emphasize the need for targeted interventions to address healthcare disparities and ensure equitable access to essential services for all individuals affected by LEVT.

Characteristic	Overall, N = 277 <sup>1</sup>	Blunt, N = 87 <sup>1</sup>	Penetrating, N = 190 <sup>1</sup>	P-value <sup>2</sup>
Age	28 (23, 38)	31 (25, 53)	27 (22, 36)	<0.001
% Male	253 (91%)	72 (83%)	181 (95%)	<0.001
Ethnicity				<0.001
White, Asian, or Other	36 (13%)	24 (28%)	12 (6.3%)	
Black	132 (48%)	28 (32%)	104 (55%)	
Hispanic	109 (39%)	35 (40%)	74 (39%)	
ISS	13.0 (9.0, 17.0)	13.0 (9.5, 19.0)	14.5 (9.0, 17.0)	0.2
Associated Fracture	130 (47%)	61 (70%)	69 (36%)	<0.001
Debridement	100 (36%)	55 (63%)	45 (24%)	<0.001
Fasciotomy				0.2
None	199 (72%)	63 (72%)	136 (72%)	
Index	66 (24%)	23 (26%)	43 (23%)	
Delayed	12 (4.3%)	1 (1.1%)	11 (5.8%)	
Amputation	48 (17%)	43 (49%)	5 (2.6%)	<0.001
Mortality during index hospitalization	48 (17%)	11 (13%)	37 (19%)	0.2
Insurance Type				0.004
Medicare/Medicaid	38 (14%)	17 (20%)	21 (11%)	
Private Insurance	42 (15%)	17 (20%)	25 (13%)	
Uninsured	87 (31%)	15 (17%)	72 (38%)	
Other	110 (40%)	38 (44%)	72 (38%)	
Median Household Income	48,939 (39,266, 67,251)	53,003 (40,444, 71,089)	46,847 (38,341, 65,805)	0.033

<sup>1</sup>Median (IQR); n (%)  
<sup>2</sup>Wilcoxon rank sum test; Fisher's exact test; Wilcoxon rank sum exact test

Figure 1: Residential Zip Codes of Blunt vs. Penetrating LEVT in Houston, TX.



## REVERSE CONTRALATERAL PROXIMAL TIBIA PLATE FIXATION AND PROVISIONAL; REDUCTION PLATING IN THE TREATMENT OF HOFFA FRACTURE

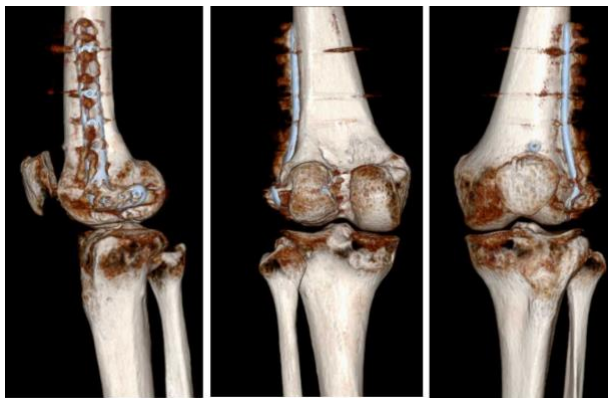
Zhaohua Liu, MD

Invited Moderator: Mayur Narayan, MD, MPH, MBA, MHPE

**Introduction:** Hoffa fracture is a rare type of distal femoral fracture that occurs in the coronal plane of either femoral epicondyle. To date, screws in combination with lateral plate fixation are widely accepted to achieve stable fixation and good results. However, up to now, there has not been a specially designed anatomical plate for lateral fixation of Hoffa fracture. We published one case report of Hoffa fracture fixed with the reverse application of “L” shaped contralateral proximal tibia plate (RCPTP) and cannulated screws, and the successful repeatability of this fixation method and more operational details need to be demonstrated. Provisional reduction plating is often used in challenging fracture patterns. In this article, we present a technique for fixation of Hoffa fractures, in which a reconstructive plate or a distal radius plate is used to keep provision reduction of the fracture, while the definitive “L” shaped contralateral proximal tibia plate is applied.

**Materials and methods:** From Oct. 2019 to Dec. 2021 in a level 2 trauma center, two Hoffa fracture cases were treated with an “L” shaped contralateral proximal tibia plate and cannulated screws. Passive knee flexion and extension began on the first day after surgery and gradually increased to the range of knee flexion and extension. Week 4 passive knee flexion and extension activities  $0^{\circ} \sim 90^{\circ}$ . Six to eight weeks after surgery, the patient began to walk non-weight-bearing with the help of crutches. The patient was allowed to carry partial weight on the toe point 8 weeks after surgery.

**Results:** Both cases with provisional reduction plating and “L” shaped contralateral proximal tibia plate fixation achieved fracture healing, and X-ray and CT scans showed fracture healing about 6 months after operation, allowing full weight bearing of the affected limb. The knee joint activity of the Hoffa fracture of the lateral condyle without free bone fragments was  $0^{\circ} \sim 120^{\circ}$ , and the knee joint HSS score was 71. The knee joint activity of the Hoffa fracture of the lateral condyle with free bone fragments was  $0^{\circ} \sim 100^{\circ}$ , and the knee joint HSS score was 78.



**Conclusion:** The use of “L” shaped contralateral proximal tibia plate fixation and the provisional reduction plating in the treatment of Hoffa fracture of femoral lateral condyle are repeatable, with satisfactory reduction, strong fixation, good fracture healing, and joint function.

**Keywords:** Hoffa fracture; Reverse contralateral proximal tibia plate; Open reduction; Internal fixation; Provisional reduction plating

**INCIDENCE OF SURGICAL SITE INFECTION IN  
CASUALTY DEPARTMENT AT A TERTIARY CARE  
HOSPITAL IN BANGLADESH: RESULTS FROM A PILOT  
SURGICAL SITE INFECTION SURVEILLANCE**

Mohammad Arif Hossain, MD

Invited Moderator: Rachel Appelbaum, MD

**Introduction:** Surgical site infection (SSI) is one of the key causes of healthcare-associated infections that develop within 30 days after surgery. The SSI incidence is high in casualty, especially in low and middle-income countries. We aimed to assess the surgical site infection rate among the surgery patients admitted to the casualty department.

**Methodology:** From 1st May to 31st July 2023, we piloted this surveillance in casualty department of Dhaka Medical College hospital. Following the World Health Organization's SSI protocol and methodology, we enrolled a total of 88 patients who went through surgery and followed up to 30 days. Wound swabs were collected from the patient who developed the SSI symptoms and sent for culture and sensitivity test.

**Result:** 40.9 % (36/88) of patients develop SSI symptoms, and the majority develop SSI symptoms during hospitalization time. However, 5% of patients develop their symptoms after discharge at home. SSIs were significantly associated ( $p=0.02$ ) with contaminated/ unclean surgery and patient age. Infected patients had more than twofold average hospital stay compared to non-infected patients. Patient's sex and socio-economic condition were not associated with infections. Practices of laboratory investigation (C/S) were very low to confirm pathogens and assess pattern of antimicrobial resistance. However predominant organisms found in C/S test were E. Coli (36%) followed by P. Aeruginosa (36%) against which most sensitive antibiotics were Tigecycline (100%) and Colistin (90%). Some commonly used antibiotics were found to be resistant such as Ceftriaxone (100%) and Co-amoxiclav (100%) followed by Cefixime (80%) and Ceftazidime (67%).

**Conclusion:** The SSI rate was very high in casualty ward, which suggests that investment in infection prevention and control practice is required. C/S test investigation should be given routinely to identify the common pathogen and prescribe antibiotics based on evidence.

**MANAGEMENT OF ABDOMINAL, OPEN ABDOMEN, AND  
LOSS OF DOMAIN WITH DERMIS AND AUTOLOGOUS  
SUSPENDED-CELL TRANSPORTATION**

Alfredo Cordova, MD

Invited Moderator: Rachel Appelbaum, MD

**Introduction:** Abdominal sepsis is a life-threatening condition that carries a high morbidity and mortality risk, such as the formation of entero-cutaneous fistulae. Management is challenging, and current practice for initial management may consist of the use of polyglactin mesh or biologics to cover intra-abdominal content. Skin substitutes may enhance the development of an optimal wound bed for grafting and provide temporary wound coverage. Decellularized and lyophilized north Atlantic cod fish skin have been reported to have properties in the 4-stages of wound healing and have demonstrated successful wound granulation for chronic and acute wounds. Subsequent resurfacing with autologous split-thickness skin graft (STSG) and suspended skin cell transplantation (SSCT) may lead to faster and complete healing of the skin grafts with reduced donor sites. We describe five cases utilizing this technique for the management of abdominal sepsis, open abdomen, and loss of domain.

**Methods:** Five critically ill patients with multiple comorbidities presented with septic shock secondary to abdominal catastrophes requiring emergent damage control operations, including a 32-year-old alcoholic and cirrhotic female with necrotizing pancreatitis and abdominal compartment syndrome, a 51-year-old female who underwent liposuction complicated with bowel injury resulting in necrotizing soft tissue infection, a 76-year-old female who underwent sigmoid resection with Hartman's colostomy for perforated diverticulitis and experienced fascial dehiscence, 55-year-old morbidly obese with remote history of a gastric bypass presented with gastric outlet obstruction with a perforation just proximal to a gastrojejunostomy stricture, and a 61-year-old morbidly obese female with a history of opioid abuse presenting with bowel perforation from stercoral ulcer. All of the cases resulted in open abdomen with underlying bowel and were treated with fish dermal graft followed by autologous cell harvesting device (ACHD).

**Results:** Xenograft integration and optimal granulation tissue was evidenced in >95% of the surface area as early as 5 days after the product application. This was considered ideal for resurfacing. Skin coverage with meshed STSG and SSCT revealed nearly 100% skin graft take and epithelization within 2 weeks. Significant donor site reduction with no donor site morbidity.

**Conclusion:** Decellularized and lyophilized fish dermis provides excellent wound coverage and enhances the formation of an optimal wound bed for grafting. Subsequent autologous SSCT reduces time of healing with smaller donor sites and donor site morbidity. For abdominal sepsis, open abdomen, and loss of domain, this technique should be considered as an alternative and efficacious treatment option.

**CORRELATION OF ICU ACQUIRED WEAKNESS(ICUAW)  
MEASURED WITH MRC(MEDICAL RESEARCH  
COUNCIL) SCORE WITH DIAPHRAGMATIC  
EXCURSION(DE) MEASURED USING ULTRASOUND : A  
PROSPECTIVE OBSERVATIONAL STUDY**

Vikas Saini, MD

Invited Moderator: Rachel Appelbaum, MD

**Primary Objective:** To assess the correlation between MRC sum score and diaphragmatic excursion measured using USG

**Secondary Objective:** To assess the sensitivity and specificity of Diaphragmatic excursion measured using USG in predicting the presence of ICUAW.

**Methods:** Patients admitted in the ICU(18-65yrs) without any prior muscular weakness on admission and ventilated for more than 48hrs were included in the study. We calculated the MRC-sum score by summing all the obtained strength values of the upper limbs and lower limbs. The diaphragmatic excursion was measured in three successive tidal volume breaths and vital capacity breaths. The mean of these readings was calculated and used for analysis. GE vivid IQ ultrasound machine was used for study.

**Results:** Out of 47 patients evaluated, 17(36.3%) patients had ICUAW. On comparing the relationship between the MRC sum score and DE normal breathing, we found a moderate correlation with a Spearman coefficient of 0.39 ( $p=0.006$ ) but a weak correlation between the MRC sum score and DE deep breathing with a Spearman correlation coefficient of 0.27 which is not statistically significant. Among patients who had ICUAW, the patients who were not extubated had a mean DE of 9mm during normal breathing and 17.6mm during deep breathing was significantly less when compared to a mean of 11.1mm during normal breathing and 19.7 mm during deep breathing in patients who were extubated

**Conclusions:** Our study concludes that diaphragmatic measurement of USG can be used as a simple screening tool for predicting ICUAW and difficult to wean and extubate patients in a busy ICU



**PORPHYRINIZED CARBON QUANTUM DOTS WITH  
BROAD-SPECTRUM ANTIBACTERIAL ACTIVITY TREAT  
WOUNDS INFECTED BY DRUG-RESISTANT BACTERIA**

Mengwei Zhang, MD

Invited Moderator: Rachel Appelbaum, MD

Severe trauma is a significant global public health issue and a leading cause of mortality in patients under 45 years old. The complex environment at the trauma scene often leads to microbial exogenous infections that are difficult to control with single drugs. Rapidly killing pathogenic bacteria and controlling wound infections are fundamental tasks for improving the survival rate and prognosis of trauma patients. In this study, glucose and porphyrin derivatives were used as precursors to synthesize porphyrinized carbon quantum dots (pCQDs) via a hydrothermal method, which exhibited broad-spectrum antibacterial activity. pCQDs demonstrated good antibacterial activity against both Gram-positive and Gram-negative bacteria, and its minimum inhibitory concentration against methicillin-resistant *Staphylococcus aureus* (MRSA) can be as low as 0.5 $\mu$ g/mL. In a BALB/c mouse wound model infected with MRSA, the use of pCQDs effectively inhibited the progression of bacterial growth, accelerated wound healing, and significantly restored body weight. Furthermore, pCQDs showed good biocompatibility in vivo. Based on this, it was observed that pCQDs could target bacteria through their surface positive charge and hydrophobic properties, leading to bacterial membrane disruption and cell death, further elucidating the specific mechanism of carbon quantum dots' antibacterial action. These findings provide important theoretical and experimental basis for the clinical application of pCQDs in the treatment of drug-resistant bacterial.

# **OPTIMIZING ECMO RESCUE IN TRAUMA BY ESTABLISHING A PHENOTYPIC APPROACH TO PATIENT SELECTION**

Larisa Shagabayeva, MD

Invited Moderator: Rachel Appelbaum, MD

**Objective:** There is evidence that extracorporeal membrane oxygenation (ECMO) is an effective salvage therapy in severely-injured patients, but survival trends have not been clearly defined. To fill this gap, one of the largest national samples of ECMO in trauma was reviewed to elucidate patient characteristics and compare survival outcomes across phenotypes.

**Methods:** All trauma patients on ECMO from 2017-2021 in the ACS Trauma Quality Improvement Program database were identified. Patients with burns and transfers were excluded. Three "phenotypes" were defined: type I was a patient with severe chest injuries (Thoracic AIS  $\geq 4$ ) that was placed on ECMO within two days of trauma. Type II was a patient without severe chest injuries (Thoracic Abbreviated Injury Score 4) that was placed on ECMO within two days of trauma. Type III was all other ECMO patients. Demographic and clinical variables in these three groups were compared with differences set at  $p \leq 0.05$ .

**Results:** In a study population of 788 patients, there were 187 (23.7%) type I, 204 (25.9%) type II and 397 (50.4%) type III trauma ECMO cases. Most patients across all phenotypes were white males who sustained blunt injuries (Table 1). Injury severity score (38 vs 23 vs 28;  $p < 0.001$ ) was highest in type I and admission systolic blood pressure was lowest in type I (108 vs 116 vs 120;  $p = 0.002$ ). There were no differences in the rate of central line-associated bloodstream infection, deep vein thrombosis, myocardial infarction, or stroke ( $p > 0.05$ ). Type III had higher rates of pulmonary embolism, acute kidney injury, severe sepsis, acute respiratory distress syndrome, and ventilator-associated pneumonia (all  $p < 0.05$ ). Type I had significantly higher mortality than type II or type III ( $p < 0.05$ ).

**Conclusion:** This is the first study to show differences in outcomes between trauma ECMO groups classified by injury and timing of ECMO cannulation, underscoring the heterogeneous indications for trauma ECMO. Patients with severe thoracic injuries pose unique challenges with a higher mortality compared to other regional injuries.

**Table 1:** Patient characteristics and outcomes across ECMO Types

	ECMO Phase			p-value
	Type I (N=187)	Type II (N=204)	Type III (N=397)	
<b>Male, N (%)</b>	158 (84.9)	156 (77.6)	341 (85.9)	0.030
<b>Age, mean (SD)</b>	30.7 (14.7)	35.0 (18.1)	35.3 (14.8)	0.003
<b>Race, N (%)</b>				0.230
American Indian	1 (0.5)	1 (0.5)	2 (0.5)	
Asian	4 (2.1)	4 (2.0)	11 (2.8)	
Black	73 (39.0)	63 (30.9)	109 (27.5)	
Pacific Islander	0 (0)	1 (0.5)	0 (0)	
Other	11 (5.9)	12 (5.9)	40 (10.1)	
White	87 (46.5)	116 (56.9)	220 (55.4)	
<b>Blunt, N (%)</b>	141 (75.4)	151 (74.0)	314 (79.1)	<0.001
<b>ISS, mean (SD)</b>	39 (15)	23 (13)	27 (13)	<0.001
<b>SBP, mean (SD)</b>	108 (40)	116 (40)	120 (36)	0.002
<b>Hospital Complications, N (%)</b>				
CLABSI	0 (0)	2 (1)	8 (2)	0.118
DVT	36 (19.4)	31 (15.3)	66 (16.7)	0.561
PE	7 (3.8)	14 (6.9)	41 (10.4)	0.019
Stroke	10 (5.4)	5 (2.5)	19 (4.8)	0.304
AKI	53 (28.3)	38 (18.7)	117 (29.6)	0.013
Sepsis	14 (7.5)	12 (5.9)	65 (16.4)	<0.001
ARDS	49 (26.2)	65 (32.3)	238 (59.9)	<0.001
VAP	20 (10.8)	21 (10.3)	76 (19.2)	0.003
MI	4 (2.2)	1 (0.5)	12 (3.0)	0.131
<b>Mortality, N (%)</b>	83 (44.4)	84 (41.2)	124 (31.2)	0.003

# SELENIUM SUPPLEMENTATION IN CRITICAL ILL PATIENTS WITH ACUTE ABDOMEN— A PROSPECTIVE RANDOMIZED AND PLACEBO-CONTROLLED TRIAL

Yutung Wu, MD

Invited Moderator: Rachel Appelbaum, MD

**Background:** The antioxidant effect of selenium (Se) is important in human physiology, but the efficacy of additional selenium supplementation (SeS) for critical patients remains inconsistent in previous studies. The study aims to determine whether SeS can improve outcomes in critical ill patients with acute abdomen.

**Methods:** This was a 3-year patient-blinded, randomized controlled trial conducted in a single medical center. Patients aged more than 20 and admitted to the intensive care unit (ICU) within 48 hours after operations for acute abdomen were enrolled. All patients were randomly assigned to receive SeS (intravenous sodium selenium 400mcg/day for 7 days) or placebo. Serum Se levels were measured on the 1st and 8th day. Mortality, length of stay (LOS), sequential organ failure assessment (SOFA) scores, and complications were compared. All patients were followed up for 30 days.

**Results:** Among the total 33 patients enrolled, mean age was 63, and 18 received SeS (Table 1). There were no significant differences in general data, comorbidities, initial SOFA scores, or Se levels (73 vs 76 ug/L,  $p=.44$ ). The 8th day Se level was significantly higher in the

SeS group (127 vs 93 ug/L,  $p<.01$ ), as well as the change in Se level (79.5% vs 19.2%,  $p<.01$ ). In-hospital and 30-day mortality (both 0 vs 0%), LOS, ICU LOS, serial SOFA scores, overall complications, and wound-

related complications were all similar in both groups.

**Conclusion:** SeS in critical ill patients with acute abdomen did not significantly impact survival, organ failure scores, LOS, or complications. Further investigation is still needed to determine the optimal dose, duration, and benefit of SeS for critical ill patients.

**Table 1.** The epidemiology, serum selenium level, and outcomes of patients.

	Total N=33	Se N=18	No Se N=15	p
Age	63 (56-80)	72 (58-84)	61 (46-76)	.166
Male/Female (%)	25/8 (75.8/24.2)	15/3 (83.3/16.7)	10/5 (66.7/33.3)	.418
1 <sup>st</sup> day Se (ug/L)	75.7 (66.7-90.5)	73.0 (65.8-88.4)	76.1 (66.1-92.9)	.442
8 <sup>th</sup> day Se (ug/L)	119.1 (91.4-139.8)	126.8 (117.5-157.9)	92.6 (69.7-122.3)	.002
Change in Se level (%)	52.4 (19.0-80.7)	79.5 (59.4-93.9)	19.2 (6.0-27.6)	<.001
In-hospital mortality (%)	0 (0)	0 (0)	0 (0)	-
30 <sup>th</sup> day mortality (%)	0 (0)	0 (0)	0 (0)	-
1 <sup>st</sup> day SOFA score	3 (2-5)	3 (2-4)	3 (1-6)	.901
8 <sup>th</sup> day SOFA score	0 (0-1)	0 (0-1)	0 (0-2)	.442
14 <sup>th</sup> day SOFA score	0 (0-1)	0 (0-1)	0 (0-1)	.556
30 <sup>th</sup> day SOFA score	0 (0-0)	0 (0-0)	0 (0-0)	.873
Length of stay (days)	17 (11-23)	17 (15-23)	17 (11-24)	.580
Length of ICU stay (days)	5 (5-7)	5 (5-6)	6 (4-7)	.556
Complication (%)	13 (39.4)	6 (33.3)	7 (46.7)	.672
Wound infection	8 (24.2)	2 (11.1)	6 (40.0)	.101
Wound dehiscence	0	0	0	-

**RISK FACTORS FOR POST TRAUMATIC EPILEPSY IN  
PATIENTS WITH NON-OPERATIVE TREATMENT: A  
RETROSPECTIVE OBSERVATIONAL STUDY**

Hikaru Odera, MD

Invited Moderator: Rachel Appelbaum, MD

**Background:** Post-traumatic epilepsy (PTE) are common and debilitating complication of traumatic brain injury (TBI) and could have harmful impacts on the patients' life. Although it has been reported seizure prophylaxis could prevent early onset seizures, little is known about the progression of neural injury over time and how this injury progression contributes to late onset seizure development. Most TBI patients with conservative therapy could be discharged under short-term medical observation from the emergency department to home or the recovery hospital; therefore, it is clinically difficult to determine whether these patients experienced long-term epilepsy occurrence. In this study, we investigated the clinical course of patients with TBI with conservative therapy, using telephone interviews, to evaluate the occurrence rate of PTE and the risk factors associated with PTE.

**Methods:** This retrospective observational study enrolled patients with isolated TBI [head abbreviated injury scale (AIS)  $\geq 3$ , and other AIS 3] and were transferred to a tertiary emergency hospital in Japan and who underwent conservative therapy between January 1, 2020 and December 31, 2022. Occurrence of epilepsy within 1 year of admission for TBI was designated as the outcome. Multivariate logistic regression analysis was performed to assess the independent risk factors for the occurrence of epilepsy. Furthermore, we evaluated the occurrence interval after suffered TBI.

**Results:** A total of 86 patients were identified, and occurrence of epilepsy was observed in 2 patients. The median length of taking antiepileptic drugs after TBI was 7 days. Although the head injury severity was significant risk factors on multivariable analysis for developing PTE, significant difference was not observed in other factors including age, sex, type of injury. The history of mental disorder was significantly associated with a shorter occurrence interval of PTE.

**Conclusions:** In this cohort study, the incidence of PTE after isolated TBI with conservative therapy was found to be higher. These findings highlight the need for long effective antiepileptogenic therapies for the patients post TBI. Large-scale, long-term studies are required to confirm the results of this study.

**A RANDOMISED CONTROLLED DOUBLE-BLINDED  
STUDY TO COMPARE KETAMINE-DEXMEDETOMIDINE  
VERSUS KETAMINE-PROPOFOL COMBINATIONS FOR  
OPIOID FREE ANESTHESIA IN PATIENTS UNDERGOING  
BRACHIAL PLEXUS INJURY REPAIR**

Sameer Sethi, MD

Invited Moderator: Rachel Appelbaum, MD

**Background and Aims:** Opioid-free anesthesia enables enhanced recovery after surgery. Drugs acting on different pain receptors and pain transmission pathways both peripherally and centrally can be used. Primary aim was to compare dose of ketamine when co-administered with either dexmedetomidine or propofol.

**Methods:** A prospective, double blinded, randomized controlled study enrolling patients aged 18-65 years undergoing brachial plexus injury repair was conducted. Patients were randomised into Group P (propofol+ketamine) and Group D (Dexmedetomidine+ketamine). Dose of Propofol (induction+maintenance @ 100mcg/kg/min) and Dexmedetomidine(bolus of 1mcg/kg followed by maintenance @ 0.5 mcg/kg/hr) was fixed. Succinylcholine 1 mg/kg was given for muscle relaxation. Ketamine was administered as bolus of 1 mg/kg followed by infusion @ 1mg/kg/hr; switched off 20 minutes before end of surgery. A >20% increase in HR and MAP from the baseline value was considered inadequate analgesia and 0.5 mg/kg of ketamine bolus was given.

**Results:** Ketamine consumption in group D was  $187.4 \pm 30$  mg as compared to propofol-ketamine group ( $132.9 \pm 45.2$  mg). Total ketamine consumption is significantly more in dexmed-ketamine group compared to propofol-ketamine group (p value 0.001). Dexmed-ketamine group had longer time of extubation and awakening. Immediate postoperative pain scores were significantly less in dexmed-ketamine group. Post-operative sedation level and total analgesic requirement in first 24 hours after surgery was similar in both groups.

**Conclusion:** It is feasible to provide opioid free anesthesia as TIVA for adult patients undergoing brachial plexus injury repair under using propofol-ketamine or dexmed-ketamine combinations effectively.

**Reference:** R. Epidemiology of Brachial Plexus Injuries in a Multitrauma Population. Neurosurgery. 1997;40:1182-1189.

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Dexmedetomidine-based versus fentanyl based total intravenous anesthesia for lumbar laminectomy. Minerva Anesthesiol. 2008;74:469-74.

# IS A DELAY IN SURGICAL STABILIZATION OF TRAUMATIC RIB FRACTURES ASSOCIATED WITH INCREASED OPERATIVE TIMES AND WORSE OUTCOMES?

Lachlan Allen, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Purpose:** Delayed SSRF has been postulated to be more difficult, due to technical issues related to bone healing and increased inflammatory tissue. This study aims to determine a relationship between timing of SSRF and intraoperative times, adjusting for all confounding factors. Additionally, clinical impacts of early vs delayed SSRF are evaluated.

**Methods:** A retrospective a-priori cohort study of all patients who underwent SSRF at a level 1 trauma centre over a 5-year period was performed. Participants were grouped into predefined cohorts; SSRF performed within 72 hours of admission, equal to or greater than 72 hours of admission and greater than 144 hours. Primary outcome was operative time between groups, secondary outcomes included post-operative complications and clinical outcomes. Multivariate regression analysis was performed on all relevant data factors.

**Results:** Mean operative times were SSRF <72hours: 235 minutes (r169-282), SSRF 72-144hrs: 227 minutes (r165-306), >144hours: 250 minutes (r 229-323) (p=0.39). SSRF performed <72 hours led to fewer post-operative complications (P<0.01), reduced hospital LOS (p=0.01), ICU LOS (p=0.01), reduced time on a ventilator (p=0.01) and reduced tracheostomy rates (p=0.01).

**Conclusion:** After accounting for confounding factors, delays in performing SSRF does not increase operative times. SSRF performed within 72 hours provides a clinical benefit.

	Less than 72 hours (n = 47; 54%)	72 to 144 hours (n = 32; 37%)	More than 144 hours (n = 8; 9%)	P
Operative Time (Minutes)	235 (169 – 282)	227 (165 – 306)	250 (229 – 323)	0.39
No. Post-Op Complications	1 (0 – 1)	2 (1 – 3)	3 (1 – 4)	<0.01
Hospital LOS (Days)	14 (9 – 17)	15 (11 – 26)	26 (16 – 48)	0.01
ICU LOS (Days)	0 (0 – 4)	5 (0 – 13)	13 (0 – 24)	0.01
Ventilator Length (Days)	0 (0 – 4)	4 (0 – 9)	9 (0 – 17)	0.01
Tracheostomy	0% (0)	6% (2)	25% (2)	0.01
Death	4% (2)	3% (1)	0% (0)	1.00

**RESUSCITATIVE MEDIAN STERNOTOMY PLUS  
ENDOVASCULAR AORTIC OCCLUSION FOR  
PENETRATING INJURIES IN THE BOX: AN ACE UP THE  
SLEEVE**

Carlos Alberto Ordóñez Gelgado, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Introduction:** Resuscitative thoracotomy and clamshell incisions are surgical approaches that have been used for severe penetrating thoracic outlet injuries. A median sternotomy (MS) is a potential alternative for access; however, it is controversial in hemodynamically unstable patients. This study aims to describe the experience of its use in combination with endovascular aortic occlusion.

**Methodology:** A prospective, observational study conducted at a level I trauma center from January 2018 to December 2023. We included all adult patients with severe (ISS>15) thoracic penetrating trauma who underwent a resuscitative median sternotomy with or without an endovascular aortic occlusion (REBOA). Patients with severe brain injury (AIS Head>3) were excluded. The primary outcome was overall mortality.

**Results:** A total of 40 patients were included. Twenty-two (55%) had a REBOA and 18 (45%) did not. The median age was 28 years (IQR 22-38), and 95% were male. Gunshot wounds were reported in 27 patients and stab wounds in 13. The median Injury Severity Score (ISS) was 25 (IQR 25-28). Fourteen patients required additional incisions (4 cervical extensions, 10 laparotomies). Patients who had a MS and REBOA: 21 had great vessel injuries, 12 had severe lung injuries and 3 had pulmonary hilar injuries. Hemorrhage control was achieved in all. Patients who underwent MS but did not have a REBOA: 10 had a great vessel injury and 8 had severe lung injuries. The REBOA group had a significantly lower systolic blood pressure upon arrival to the trauma bay 73 mmHg (IQR: 60-90) vs. 90 mmHg in the non-REBOA group (IQR: 83-132)  $p=0.007$ . Median systolic blood pressures were able to equalize among both groups within the first 5 minutes after achieving endovascular aortic occlusion and remained consistently similar at 30 and 60 minutes [90 mmHg (IQR: 84-99) vs. 95 mmHg (IQR: 89-110)]  $p=0.6$ . The median duration of aortic occlusion was 33 minutes (IQR: 26-70). Estimated blood loss was higher in the REBOA group [3000 ml (IQR: 2500-3050)] compared to the non-REBOA group [2000 ml (IQR 1000-3325)]  $p=0.12$ . Implementation of thoracic damage control surgery was more frequent in the REBOA group (77% vs. 28%;  $p=0.004$ ). Overall mortality between groups was not statistically significant: 3 (13%) vs. 1 (5%)  $p=0.2$ .

**Conclusion:** A resuscitative median sternotomy for patients with penetrating thoracic injuries in the box is an effective approach to control major vascular injuries. Rescue maneuvers such as the use of a REBOA in these extremely difficult cases is not only feasible but may also be necessary to achieve hemorrhage control and avoid complete cardiovascular collapse.

**HEART INJURY AS A PROGNOSTIC FACTOR IN BLUNT CHEST TRAUMA PATIENTS UNDERGOING OPEN CARDIOPULMONARY RESUSCITATION (OCPR): A TQIP STUDY**

Yauren Chang, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Purpose:** The efficacy of open cardiopulmonary resuscitation (OCPR) in trauma patients remains a topic of debate. This study examines the role of OCPR in the management of blunt chest trauma patients using nationwide real-world data.

**Methods:** From 2014 to 2015, we retrospectively queried the National Trauma Data Bank for patients with blunt chest trauma undergoing cardiopulmonary resuscitation (CPR). We analyzed their outcomes in the emergency department (ED), focusing on patients with initial signs of life. Additionally, we studied a subset of patients who survived beyond the ED, emphasizing the duration of survival after ED discharge.

**Results:** A total of 420 patients were included in the study, with 65 undergoing OCPR and 335 receiving conventional CPR. The average overall mortality rate was 88.1% (N=50). Among all patients receiving CPR for blunt chest trauma, those undergoing OCPR were younger (42.9 years vs. 51.1 years,  $p=0.005$ ), exhibited a significantly higher incidence of heart injuries (27.3% vs. 17.9%,  $p=0.006$ ), and had a lower Injury Severity Score (ISS) (36.6 vs. 28.5,  $p=0.002$ ). In the case of blunt chest trauma patients subjected to OCPR, survivors demonstrated a notably higher incidence of heart injuries (66.7% vs. 20.3%,  $p=0.029$ ). Conversely, for patients not administered OCPR, a trend emerged where survivors displayed a lower proportion of heart injuries (4.5% vs. 12.9%,  $p=0.110$ ). Among all patients receiving CPR for blunt heart injury, patients undergoing OCPR exhibited significantly higher ED survival rates (81.3% vs. 40.5%,  $p=0.005$ ) as well as overall survival rates (25.0% vs. 4.8%,  $p=0.043$ ). The overall survival rate for patients after ED survival was 16.9% ( $n=9$ ) beyond the first day post-ED discharge, 13.2% ( $n=7$ ) beyond one week post-ED discharge, and 11.3% ( $n=6$ ) over the long term.

**Conclusion:** In blunt chest trauma patients with heart injuries, open cardiopulmonary resuscitation (OCPR) showed potential benefit for improved outcomes. Nevertheless, overall survival rates remained low, underscoring the need for further research and multidisciplinary approaches in managing these cases.



## PNEUMOTHORAX DETECTION IN THE ED: HOCUS POCUS?

Randeep Jawa, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Introduction:** The incidence of pneumothorax (PTX) in polytrauma may be as high as 20%. We identified major trauma activations in which point of care ultrasound (POCUS) was performed. We assessed its ability to identify clinically significant PTX (tube thoracostomy placed within 2 hours) as compared to CT scan findings or clinical confirmation (ie rush of air).

**Methods:** All full adult trauma activations admitted from 2019-2022, excluding traumatic arrests, transfers from outside hospitals, or those without POCUS exam, were included. 541 subjects with 87 % of those being blunt injury patients were evaluated for presence or absence of tube thoracostomy, and accuracy of POCUS based on training level of providers. 100% of POCUS exams were reviewed by the POCUS director and an ultrasound fellowship trained faculty member for accuracy of data.

### Results:

Total trauma patients	541
Injury Severity Score	16±13
Pneumothorax	76 (14%)
Chest tube for PTX (n)	53
Chest tube for clinically significant PTX	40
CXR sensitivity	47%
POCUS sensitivity - overall	41%
POCUS sensitivity clinically significant PTX	68%
POCUS positive predictive value for clinically significant PTX	100%
POCUS false negative rate	30%

**Conclusion:** Total PTX rate during study period was 14%. A chest tube was required in 70% of patients with PTX. The overall sensitivity of POCUS for detection of PTX was similar to CXR. POCUS sensitivity improved with level of training. POCUS has a high PPV for diagnosing clinically significant PTX. Quality review showed 12 total missed PTX with 6 of those being clinically significant. If POCUS sensitivity was adjusted for quality review interpretation, the overall sensitivity for diagnosing PTX was 57% and improved to 84% for clinically significant PTX. More attention to image acquisition and image interpretation may be needed.

# BEYOND MEDIASTINAL WIDENING: INNOVATIVE SCREENING AND PREDICTION METHODS FOR AORTIC INJURY

Yu-Hao Wang, MD

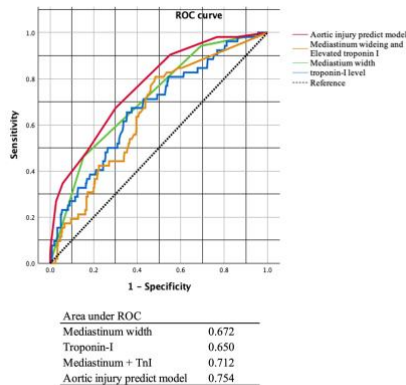
Invited Moderator: Joseph Forrester, MD, MSc

**Introduction:** Mediastinal widening is commonly utilized and extensively taught as a screening mechanism for aortic injury in trauma patients. Despite its widespread use, an increasing body of evidence highlights the method's limited diagnostic accuracy. In response to this challenge, our study aims to develop and introduce a more accurate method for diagnosing aortic injury in this vulnerable patient population.

**Materials and Methods:** A retrospective analysis was conducted on patients who underwent chest CT scans at our hospital. The mediastinum width was measured on supine position X-rays. Patients were then categorized into two groups: those with aortic injuries and those without. Risk identification was performed through a logistic regression model, leading to the establishment of a final model. The accuracy of this model was compared to that of mediastinal widening alone through the construction of Receiver Operating Characteristic (ROC) curves.

**Results:** During the period from 2019 to 2022, a total of 495 patients with thoracic trauma received contrast-enhanced chest CT scans at our facility. Out of these patients, 52 experienced traumatic thoracic aortic injuries. We found that a mediastinum width > 8.5cm has a better predictive value than the cutoff value of 8cm. In multivariate logistic regression analysis, significant risk factors for traumatic aortic injury included: shock (OR: 2.12, 95% CI: 0.98-4.59), left hemothorax (OR: 2.86, 95% CI: 1.47-5.78), mediastinum width > 8.5cm (OR: 3.48, 95% CI: 1.81-6.70), elevated Troponin-I (OR: 2.90, 95% CI: 1.45-5.81), and pericardial effusion (OR: 6.03, 95% CI: 1.77-20.48). Utilizing these significant predictors, a model was established after transferring the odds ratio to weighting. The resulting Receiver Operating Characteristic (ROC) curve yielded an Area Under the Curve (AUC) of 0.754, demonstrating superior diagnostic accuracy compared to the use of mediastinal widening alone, which had an AUC of 0.632.

**Conclusions:** In conclusion, we identified a new significant risk factor for aortic injury, Troponin-I elevation. Also, combining shock upon admission, Troponin-I elevation, left hemothorax, pericardial effusion, and traditional mediastinal widening offers a straightforward, feasible, and acceptable screening method for Blunt Thoracic Aortic Injury (BTAI). This approach enhances detection, ensuring timely and accurate diagnosis.



## EVOLUTION OF VIDEOTHORACOSCOPY IN THORACIC TRAUMA

Rafael Andrade-Alegre, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Objective:** Videothoracoscopy for thoracic trauma has evolved through the years. More cases are performed everyday, and indications are expanding. Surgical experience and improvements in technology has contributed to this outcome. A retrospective analysis of videothoracoscopy in thoracic trauma is carried out at the Section of Thoracic Surgery in our institution.

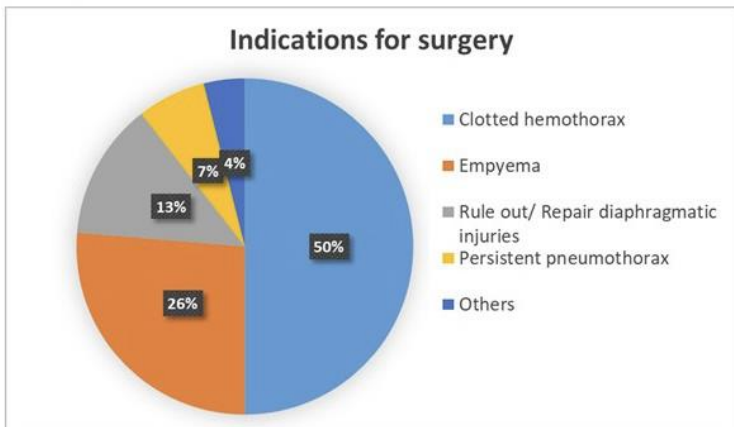
**Methods:** This is a retrospective analysis of all the patients with thoracic trauma managed by videothoracoscopy from january 2010 to december 2023 by a single surgeon. The following variables were included: epidemiological, type of trauma, time to surgery, diagnosis, procedure performed, surgical time, percentage of conversion, complications, mortality, postoperative days and follow up.

**Results:** 66 patients underwent videothoracoscopy for thoracic trauma. 61 were males (92.4%). Mean age was 30 years (+/- 13). 21 of the patients had gunshot wounds, 23 knives injuries and 22 blunt chest trauma. 65% of the cases were operated more than 7 days from suffering the trauma (range 8 to 48) ( Fig.1). Main indications for surgery were: 38 clotted hemothorax, 20 empyemas, 10 rule out/repair diaphragmatic injuries, 5 persistent pneumothoraces and few uncommon cases: 2 empalaments and 1 heart injury (Fig.

2). Some of the cases had more than 1 indication for surgery. Conversion rate was 2 (3%). Complications were 9 (13.6%), there was no mortality in this series. Almost double of the cases (43) were performed in the second half of the study.

**Conclusions:** Original indications for videothoracoscopy in thoracic trauma has expanded over the years, as more type of traumatic injuries are now approached through minimally invasive surgery. The experience gained and the safety of videothoracoscopy has allowed us to increase substantially the number of cases and type of traumatic chest injuries treated in the last years of the study. The low number of complications and the percentage of conversion supports its earned position in the management of thoracic trauma. An important number of the patients would benefit from earlier surgery, therefore efforts should be made for timely referrals.

Fig. 2



Others: 2 empalaments, 1 penetrating heart injury

## **THORACIC IRRIGATION FOR TRAUMATIC HEMOTHORAX: A SYSTEMATIC REVIEW AND META- ANALYSIS**

Nicole Lyons, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Introduction:** Traumatic hemothoraces (HTX) are common, and tube thoracostomies (TT) are placed to drain them. However, residual blood, known as a retained HTX, can develop into a fibrothorax or empyema requiring secondary intervention. A recently proposed method to prevent retained HTX is irrigation of the thoracic cavity after TT placement. We hypothesized that patients treated with thoracic irrigation will have a lower failure rate.

**Methods:** Pubmed, EMBASE, and Scopus were searched from inception to March 2024 and the abstracts from 2019-2024 from three national trauma conferences were also screened. Studies with adult trauma patients with traumatic HTX who received a TT and reported outcomes of patients who underwent thoracic irrigation were included. The primary outcome was failure rate defined as retained HTX requiring a second intervention. Secondary outcomes included TT duration, hospital length of stay (HLOS), and infectious complications (empyema and pneumonia). Cumulative analysis was performed with Chi-square for dichotomous variables and unpaired t-test for continuous variables. A fixed effects model was applied for meta-analysis.

**Results:** Five studies were included in the analysis. There were two retrospective and three prospective observational studies. These studies included 1,261 patients who received 1,290 tube thoracostomies (483 irrigated, 807 nonirrigated). The mean age of patients was 40 years, 83% were male, average ISS was 17, and 42% had penetrating trauma. Failure rate was significantly lower in the irrigation group on cumulative analysis (10.8% vs 18.1%,  $p=0.001$ ) and meta-analysis (relative risk=1.1, 95% confidence interval=1.04 to 1.21,  $p=0.004$ ). Additionally, the irrigation group had a shorter HLOS (8.7 vs 10.5 days,  $p=0.001$ ). TT duration was similar in both group (4.2 vs 5.5 days,  $p=0.091$ ) and there was no difference in infectious complications (7.0% vs 8.8%,  $p=0.264$ ).

**Conclusions:** Patients who undergo thoracic irrigation have a lower rate of retained HTX leading to less secondary interventions as well as a shorter HLOS. Thoracic irrigation for traumatic HTX should be considered, however, randomized studies are still needed prior to development of guidelines.

**MASSIVE HEMOTHORAX ASSOCIATED WITH  
THORACIC VERTEBRAL FRACTURES: A  
RETROSPECTIVE ANALYSIS**

Keita Sato, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Introduction:** Traumatic hemothorax due to thoracic vertebral fracture can have a life-threatening outcome, hemorrhagic shock and severe coagulopathy. However, due to its rarity, epidemiology and clinical characteristics are not well known. We performed a retrospective analysis of trauma cases at our institution.

**Methods:** Patients diagnosed with thoracic vertebral fracture who were admitted to our trauma center between January 2021 and December 2022 were included. Of these cases, we excluded those with major vascular injuries, rib fractures, or other sources of hemorrhage. This allowed us to select cases in which hemothorax was caused by vertebral fractures, and to examine the patient's background, characteristics, and severity of injury.

We also focused on diffuse idiopathic skeletal hyperostosis (DISH) or ankylosing spondylitis (ASH) lesions and divided patients into DISH and non-DISH groups based on Resnick's criteria.

**Results:** Among 147 cases of thoracic vertebral fractures identified, many were isolated fractures due to falls, with 11 cases (7.5%) presenting with concomitant hemothorax. Among them, 6 cases (3.8%, mean age 80.7 years) had massive hemothorax, requiring hemostatic interventions in all cases. In all cases, hemorrhage from the vertebral bone perforated the pleura and resulted in hemothorax. All cases exhibited hemorrhagic shock and severe coagulopathy, resulting in three cases of fatal hemorrhage. Additionally, all cases showed evidence of DISH, and the occurrence of hemothorax was significantly associated with DISH ( $p=0.017$ ).

**Conclusion:** Massive hemothorax complicating thoracic vertebral fractures was observed in 3.8% of cases, all of which had a severe clinical course. DISH may pose a risk in these cases because ossification of the anterior longitudinal ligament and tendons can cause a "lever arm effect" that makes even small forces susceptible to vertebral fractures. While vertebral hemorrhage associated with DISH is rarely discussed as a source of bleeding during the acute phase of trauma, the rich vascular network surrounding the vertebral body underscores its critical role as a potential source of fatal bleeding.

We will present a typical case of fatal hemothorax associated with DISH and discuss it along with specific methods of hemostasis.

**IMPACT OF THORACIC TRAUMA ON MORBIDITY AND  
OUTCOME: SIX YEARS' EXPERIENCE FROM TERTIARY  
CARE LEVEL 1 TRAUMA CENTRE IN INDIA**

Amit Singh, MD

Invited Moderator: Joseph Forrester, MD, MSc

**Background:** Trauma to thoracic region is fatal leading to 25 % of mortality. 85-90 % of thoracic patients can be rapidly stabilized and resuscitated. The aim of this study is to measure the overall morbidity, mortality among acute thoracic injury patients and then to correlate mortality with several demographic, pathological, and management factors.

**Methodology:** Retrospective observational study of records of thoracic injury patients admitted in trauma emergency between July 2018 to December 2024. The primary outcome was overall mortality. The secondary outcome was an association with age and sex, concomitant lung injuries, mechanical ventilation, ICU stay, need for ICD insertion, sepsis, pneumonia. and analgesia with overall mortality rate.

**Results:** Thoracic injuries comprised 21.9 % of all trauma admissions and the mechanism was blunt in 92.5% of cases. Road traffic accidents 89.7% followed by assault, were the most common modes of injuries. Longer ICU stay and longer Mechanical ventilation were noted in the mortality group as compared to survived group (p value less than 0.05). Associated lung injuries, sepsis, pneumonia has significant association. Overall mortality was found to be 21.6 %

**Conclusion:** Thoracic injuries isolated or in association with extra thoracic injuries poses significant risk to life. Concomitant lung contusions, pneumothorax, hemothorax and injury severity scores, and age are independent factors which contribute to higher mortality.

**PREVENTABLE AND POTENTIALLY PREVENTABLE  
DEATHS AMONG ROAD TRAFFIC FATALITIES IN CHIBA  
PREFECTURE: PROBLEMS IN THE JAPANESE  
HOSPITAL CARE SYSTEM REVEALED BY  
INVESTIGATION OVER A 12-YEAR PERIOD**

Atsushi Hirabayashi, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Background:** Few studies in Asia have evaluated the quality of hospital care for road traffic trauma over time.

**Purpose:** To clarify the details of preventable deaths (PD) and potentially preventable deaths (PPD) among road traffic fatalities in Chiba Prefecture, Japan, in order to evaluate the quality of transport hospital care and to identify problems in the Japanese trauma care system.

**Methods:** Among road traffic fatalities occurring within 24 h after traffic accidents from 2009 to 2020 in Chiba Prefecture, patients with signs of life (SOL+) at the time of emergency medical services (EMS) contact were included in the study. Information was collected from police, fire departments, and medical facilities, and each case was classified as PD, PPD, or not preventable death (NPD) at a case review meeting. Identified problems were counted, and multiple problems could be counted from one case.

**Results:** Of 824 road traffic fatalities, 161 (19.5%) were classified as PD or PPD. Bleeding was the cause of death in 123 of these cases (76.3%). Problems included errors in circulatory management during initial treatment (62 cases), errors in treatment strategy (56 cases), delays in diagnosis/treatment (34 cases), and delays in hemostasis (38 cases).

**Conclusion:** Among cases with SOL+ at EMS contact, 19.5% were PD or PPD, and 76.3% of these deaths were due to hemorrhage. Of PD and PPD cases, 62% had problems with circulatory control errors and delayed hemostasis in initial after arrival at the emergency department.

**OUTCOME OF SEVERE TRAUMA PATIENTS REQUIRED  
DAMAGE CONTROL SURGERY BY THE DIFFERENCE  
BETWEEN 'DOCTOR-CAR' AND AMBULANCE FROM  
JAPAN TRAUMA DATA BANK**

Yohei Iwasaki, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Background:** The doctor-car patient transport system has developed widely in Japan. Nowadays, prehospital emergency care by doctor-car system has been spreading. However, there is a knowledge gap on efficacy of doctor-car system for severe trauma cases.

**Aim:** The aim of this study is to compare ground transport system for severe trauma patients and assess efficacy of prehospital care by doctor-car.

**Method:** We used the Japan Trauma Data Bank (JTDB) version 2022 (N = 88,817). Study period was from 1<sup>st</sup> January 2019 to 31<sup>st</sup> December 2021. We extracted severe trauma cases (ISS 16 or more) transported from scene and required damage control surgery (DCS) from JTDB. We compared transportation systems of doctor-car (group D) and general ambulance operated by emergency medical systems (EMS) (group A). Primary outcome was survival rate. Secondary outcomes were transport time, time from arrival at hospital to DCS initiation and length of ICU stay.

**Results:** Total number of severe trauma cases was 28,490. The number of group D cases was fifty, and the number of group A cases was 911, separately. There was no statistical difference in survival rate between group D (78%) and group A (75%). Transport time (minute) was 15 [11, 25] in group D and 12 [8, 19] in group A. Time from arrival to DCS initiation (minute) was 126 [48, 291] in group D and 186 [89, 474] in group A. Length of ICU stay (day) was 6 [3, 14] in group D and 5 [1, 13] in group A.

**Conclusion:** There was no statistical difference in survival rate between doctor-car and general ambulance for severe trauma patients who required damage control surgery. It suggested that doctor-car system shortened time from arrival to DCS initiation and extended transport time slightly for severe trauma cases.



## INSIGHTS INTO MILITARY-CIVILIAN TRAUMA SYSTEM INTEGRATION AND ITS EFFECTS ON BLOOD PRODUCT AVAILABILITY

Joseph Aryankalayil, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Introduction:** In many countries, military and civilian trauma systems often operate in parallel. Increased integration offers potential to improve efficiency, capacity and outcomes for civilian and military populations. A pivotal challenge shared by both sectors is ensuring adequate access to blood, a critical resource for life-saving interventions.

**Methods:** We distributed an international survey that captures information on five key sectors of an integrated military-civilian trauma system: patient care, education/training, formal partnerships, global health engagement, and communication. Based on expert consensus, we created a standardized scoring system to quantitatively measure levels of integration, allowing classification into three distinct groups/tertiles, ranging from minimal (Type I) to robust (Type III). This method allowed analysis of the association of numerous trauma system factors with increased integration status.

**Results:** The international survey on military-civilian trauma system integration gathered 246 responses from 77 individual countries. Respondents were asked about timing and availability of various blood products within their local hospitals. The American College of Surgeons recommendation for massive transfusion availability in less than 15 minutes in trauma centers was used as the benchmark during analysis. 25% of Type I integration countries reported availability of a massive transfusion protocol in less than 15 minutes, compared to 53.8% of Type II integration countries, and 57.7% of Type III integration countries (Tau-b correlation  $p < 0.05$ ). There was also a significant correlation between availability of packed red blood cells in less than an hour and increased integration status (Tau-b correlation  $p < 0.05$ ). Blood storage capabilities underlying the rapid availability of blood products in higher integration countries was evaluated. On-site blood banking did not demonstrate any association with higher integration status, but there was a trend with utilization of local blood banking and higher integration status (Type I: 48%, Type II: 61.5%, 76.9%).

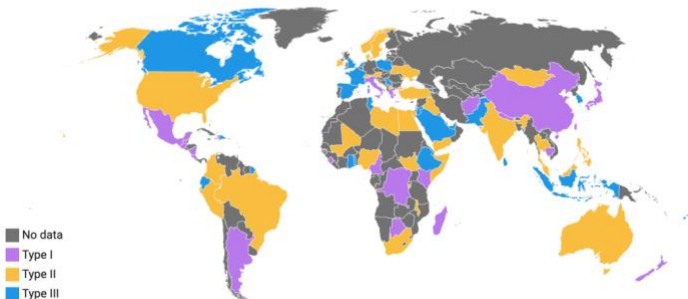
### Conclusion:

Our survey findings advance understanding of the global landscape of military-civilian trauma system integration, including the association with improved

blood product availability with higher integration status, and the conducive nature of local blood banking for military-civilian integration. This study sets a foundation, for an adaptable framework for implementing meaningful trauma system integration to improve efficiency, capacity and patient outcomes.

### Global Landscape of Civilian-Military Trauma System Integration

5 key domains were measured: patient care, education/training, formal partnerships, global health engagement, and communication. Countries were classified into three tertiles based on survey response scoring, ranging from Type I (least integration) to Type III (robust integration).



# **PRESENCE OF GERIATRIC CONSULT SERVICE IS ASSOCIATED WITH DECREASED HOSPITAL-LEVEL MORTALITY FOR GERIATRIC TRAUMA PATIENTS**

Alexander Orboodabi, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Introduction:** American College of Surgeons Geriatric Trauma Best Practice Guidelines recommend the inclusion of geriatricians as a key part of the care team for seriously injured older adults. We hypothesized that trauma centers with a geriatric consult service would have 1) more geriatric-focused processes for care and 2) lower hospital-level mortality for injured older adults.

**Methods:** TQIP-participating trauma centers were surveyed regarding compliance with geriatric-focused processes for care, including presence of geriatric consult service, palliative care consult service, geriatric pharmacists, standardized process for assessing frailty, and anticoagulation reversal protocols. We calculated hospital-level observed to expected (O:E) mortality for geriatric trauma patients treated at surveyed trauma centers using TQIP data, controlling for patient demographics, comorbidities, and injury severity. High-mortality hospitals were defined as those in the highest quartile of O:E ratio for mortality. Multivariable logistic regression was performed to assess the association of geriatric consult service availability with high-mortality hospitals while controlling for other hospital-level characteristics, including ACS verification level, number of beds, teaching status, and compliance with other geriatric-focused processes for care.

**Results:** Geriatric consult services were available at 49 of the 145 included trauma centers (34%). Hospitals with a geriatric consult service were more likely to have level I designation (61% vs. 12%,  $P=0.001$ ), a standardized processes for assessing frailty (43% vs. 15%,  $P=0.001$ ), and availability of a geriatric pharmacist (55% vs. 33%,  $P=0.012$ ) (Table 1). On unadjusted analysis, hospitals with a geriatric consult service were less likely to have higher-than-expected mortality (18% vs. 50%,  $P=0.001$ ). On adjusted multivariable logistic regression, presence of a geriatric consult service was associated with decreased odds of higher-than-expected mortality (OR 0.37, 95% CI 0.14-0.96,  $P=0.041$ ).

**Conclusion:** Hospitals with a geriatric consult service have lower hospital-level mortality for older adult trauma patients and have more processes in place to assess and treat these patients. Geriatric specialists are an essential component of the trauma team for seriously injured older adults.

	No Geriatric Consult Service (N = 96)	Geriatric Consult Service Available (N = 49)	P-Value
Availability of Palliative Care Consult Service	92 (96%)	49 (100%)	0.188
Availability of Geriatric Pharmacists	32 (33%)	27 (55%)	0.012
Standardized Process for Assessing Frailty	14 (15%)	21 (43%)	<0.001
Anticoagulation Reversal Protocol	81 (84%)	41 (84%)	0.545
Level I Trauma Center	11 (12%)	30 (61%)	<0.001
University Hospital	15 (16%)	26 (53%)	<0.001
Hospital size >400 beds	31 (32%)	36 (74%)	<0.001

# THE CORRELATION OF TRANSFER PATTERNS AND MORTALITY RATES AFTER ESTABLISHING A TRAUMA CENTER

Dowan Kim, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Background:** The establishment of a trauma centers has significantly impacted the landscape of trauma care, often leading to changes in patient transfer patterns. Centralization of severe trauma patients refers to the trauma centers equipped with the resources, expertise, and facilities to provide the highest level of care for traumatic injuries. This study investigates the paradigm shift in transfer patterns before and after the implementation of a trauma center, focusing on the effects of transportation type distribution and outcomes.

**Methods:** This retrospective study based on Trauma Data Base between January 2017 and December 2022 at the single center. Demographic data, transfer patterns, trauma score, destination, distance, mode of transfer, and survival outcomes of all the patients were reviewed. The primary outcome was in-hospital mortality.

**Results:** During this period, the number of severe trauma patients was 3,426 (direct versus in-direct = 1,131 vs 2,315). And, direct transport increased from 18.6% to 40.1%, and especially the transport rate of severe trauma patients (ISS > 16) rose sharply from 22.1% to 50.7%. In contrast, the percentage of transfers from other medical institutions

decreased from 53% to 28% and the transport rate of severe trauma patients declined from 64.2% to 34.6%. The survival outcome of patients immediately direct transport with ambulance was statistically significantly improved ( $p=0.03$ ).

**Conclusion:** Initial findings suggest potential improvements in patient outcomes in terms of reduced mortality rates and improved clinical management. In this study, we were able to compare changes of in hospital visit after the establishment of a regional trauma center. The number of patients visiting hospitals directly has increased, and we estimated that the prognosis of patients direct visiting hospitals may be not inferior after adjusting for the preventable death rate. We suggested centralized expertise and resources, streamlined communication and enhanced referral system will improve the mortality rate.

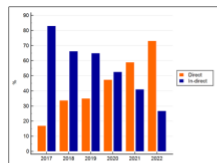


Fig. 1. Type of transfer to trauma center, Chi-squared test for mortality (n=10,000).

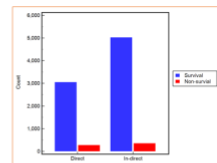


Fig. 2. Total comparison between patient transport pattern (Direct versus Indirect).

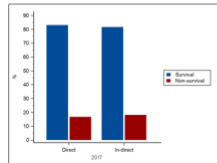


Fig. 3. Comparison of mortality between patient transport pattern (Direct versus Indirect, in 2017).

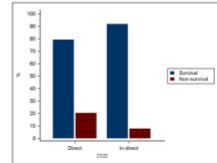


Fig. 4. Comparison of mortality between patient transport pattern (Direct versus Indirect, in 2022).

# VARIABILITY IN CT IMAGING PRACTICES IN GERIATRIC TRAUMA: A SECONDARY ANALYSIS OF AN EAST MULTICENTER TRIAL

Arnav Mahajan, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Introduction:** Computed tomography (CT) is an essential diagnostic tool for trauma care. However, limited guidance exists regarding when to obtain CT imaging for geriatric patients sustaining blunt traumatic injuries. We hypothesized there would be significant variability in CT imaging practices

**Methods:** A secondary analysis of an EAST Multicenter Trial at 18 trauma centers (TCs) (11/2020-12/2021) was performed. We included blunt trauma patients aged 65+ with a Glasgow Coma Scale  $\geq 14$  seen by a trauma team. We collected whether CT imaging was obtained of the following body regions: head, cervical spine, chest, abdomen/pelvis, thoracolumbar (T/L) spine. Variables analyzed included sex, TC level, and the team ordering scans (trauma surgery, emergency medicine [EM], or the referring hospital [OSH], defined as that team ordering  $>50\%$  of scans for a patient). Logistic regression was performed to examine whether sex, TC level, or ordering team were associated with use of CT scans. Regressions were adjusted for injury mechanism, positive physical examination within the CT body region, anticoagulants, and age, with adjusted odds ratios (aOR, 95%CI) reported.

**Results:** For 5,001 patients, 4,762 CT scans were performed. Most patients were females (55%), 16% were treated at level 2 TCs, and 65% suffered ground level falls. CTs were most frequently performed on the head (96%) and least frequently on the T/L spine (22%). Trauma surgery teams ordered the majority (55%) of scans, followed by EM (35%) and OSH (10%). Level 2 TCs were associated with lower odds of receiving a CT of all body regions (Table). Compared to trauma surgery, EM team ordering was associated with lower odds of CT scans for all body regions besides head, and OSH ordering was associated with lower odds of scans for all regions besides T/L. Sex did not influence whether CTs were obtained.

**Discussion:** Our study demonstrated that non-clinical factors, such as TC level and primary ordering team, were associated with whether a patient received CT imaging, even after adjusting for clinical factors like physical exam findings and injury mechanism. These findings suggest that evidence based guidance is needed to support decision-making for imaging the geriatric trauma population.

**Table 1: Adjusted Odds Ratios (aOR, 95% CI) for Computed Tomography Imaging by Body Region**

Factor	Head	C-spine	Chest	A/P	T/L
Level 2 Trauma Center (vs. Level 1)	0.58 * (0.40, 0.86)*	0.63 * (0.47, 0.84)	0.77 * (0.65, 0.91)	0.81 * (0.68, 0.95)	0.43 * (0.34, 0.55)
Female Sex (vs. Male)	0.81 (0.59, 1.13)	0.99 (0.78, 1.24)	0.90 (0.78, 1.02)	0.91 (0.80, 1.04)	0.89 (0.77, 1.04)
EM Team (vs. Trauma Team)	1.08 (0.75, 1.55)	0.67 * (0.52, 0.87)	0.64 * (0.56, 0.74)	0.72 * (0.63, 0.83)*	0.46 * (0.39, 0.54)
OSH (vs. Trauma Team)	0.52 * (0.34, 0.80)	0.36 * (0.27, 0.50)	0.56 * (0.45, 0.70)	0.62 * (0.50, 0.77)	0.90 (0.70, 1.14)

ED = Emergency Medicine; C-spine = Cervical spine; A/P = Abdomen/Pelvis; T/L = Thoracolumbar spine  
All Regressions adjusted for injury mechanism, physical examination, anticoagulants, age

\* indicates  $p < 0.05$

## **DEVELOPING A GEOSPATIALLY INFORMED TRAUMA TRIAGE SYSTEM FOR IMPROVED PRE-HOSPITAL MANAGEMENT OF TRAUMA IN LOW- AND MIDDLE-INCOME COUNTRIES: A USER-CENTERED APPROACH**

Arnav Mahajan, MD

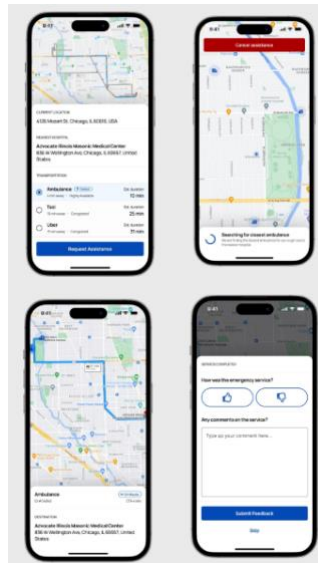
Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Introduction:** Thailand lacks a true emergency ambulance service, resulting in only 7.28% of emergency cases being facilitated by ambulances. Of these, only 10% are advanced or basic life support ambulances. This results in a burden of traumatic injury that is unmet by current pre-hospital systems that requires an immediate solution. Here, we highlight the ongoing development of our proposed ambulance system, and to contextualize findings to other low-middle income countries.

**Method:** We have developed an application that uses Google Maps, OpenStreetMaps, and various ride-sharing service API's to input traffic information to help ambulance services and patients find the nearest hospital and the most optimum route to reach a Level 1 Trauma Center. Our application follows principals of user-centered design and meets the needs of stakeholders in Thailand.

**Results:** The application provides directions, location of hospitals and trauma centers, and a triage system based on the Medical Priority Dispatch System. The application provides accident reporting, safety tips, ambulance services, push notifications, and car service information. We have designed a patient facing model to address the needs of 93% of all patients, and an ambulance model to meet the needs of the remainder of the population that visits emergency departments annually.

**Discussion:** Developing a novel application to develop geographically informed triage and transport of traumatic injury patients in low-middle income countries is of vital importance. Thailand has implemented a policy that democratizes access to care, allowing patients to be transferred to either a private or public hospital and not be charged for the first 72 hours. This paper highlights the importance of increasing open access data to study geographic disparities of care as this is a major limitation in LMICs.



**VALIDATION OF REAL-TIME LOCATION SERVICE  
(RTLS) PRE-HOSPITAL TIME TO ARRIVAL TOOL IN THE  
SOUTHEAST MINNESOTA REGION USING AN  
ADVANCED GEOSPATIAL MAPPING MODEL FOR  
TRAUMA**

Sergio Navarro, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Background:** Major trauma is a leading cause of premature death and disability worldwide, and many healthcare systems seek to improve outcomes following severe injury with provision of pre-hospital critical care, particularly in rural trauma care. This study developed and validated a geospatial model to implement a real-time location service (RTLS) tool with ability to provide estimated transport time looking at both ground emergency medical service (GEMS) and helicopter emergency medical service (HEMS) time of transport in the Southeast Minnesota regional area.

**Methods:** Pre-hospital data was extracted for the emergency response for trauma patients arriving at a Level I trauma center in the Southeast Minnesota region from Oct 2018 through Oct 2023. Data was extracted on location and time of incident, mechanism of injury, on-scene times, and transport teams, and hospital regions. A model was developed to predict transport time based on GEMS and HEMS, geographic location of injury, location of Level 1 trauma centers, atmospheric conditions, traffic conditions, seasonality, and day or night period. Time to other nearby Level 1 trauma centers, in addition to consideration of hospital capacity, as reported by the State of Minnesota, were also examined. Predicted times were compared to actual recorded transport times. Variance in repeated transport routes was also evaluated for the ten most common routes over both ground and flight times. Data reported as median, interquartile range defined as 25th and 75th percentile.

**Results:** Eight hundred and nine trauma incidents (361 GEMS, 448 HEMS) were included in the analysis. Using the RTLS tool, the mean predicted ground times and rotor flight times were found to be within 1% and 10% of actual GEMS and HEMS reported travel times, respectively. Actual transport time variance was assessed, with variance of GEMS at 20% (2%-35%), and HEMS at 27% (17%-38%).

**Conclusion:** Preliminary validation of a RTLS enhanced pre-hospital tool in a regional area, indicates that when combined with trauma center data, this tool provides key logistical information regarding severely injured patients. This tool may help inform enhanced pre-hospital critical care responses by GEMS and HEMS teams.

WITHDRAWN

## **THE IMPACT OF IMPLEMENTING THE JAPAN-AACN (D-CALL NET: DCN) DOCTOR DISPATCH SYSTEM**

Tomokazu Motomura, MD

Invited Moderator: Vanessa Ho, MD, PhD, MPH

**Introduction:** In 2023, there were 308,000 traffic accidents in Japan, resulting in 365,000 injuries and 2,678 fatalities. Although emergency physician dispatch systems using helicopters (doctor helicopters) and emergency vehicles (doctor cars) have been developed in Japan, speeding up their implementation would be expected to save additional lives.

Physician Dispatch via Automated Accident Collision Notification (D-Call Net: DCN): Using approximately 2.8 million police data entries from 2000 to 2011, an algorithm was developed to link vehicular engineering data (e.g.,  $\Delta v$ , collision direction, number of collisions, seatbelt usage) with the probability of serious injuries among car occupants. In the event of an accident, engineering data from the vehicle's event data recorder (EDR) are automatically sent to a dedicated server, where the probability of serious injuries is calculated. This information is then forwarded to the fire department command center and the hospitals serving as bases for doctor helicopters and doctor cars in the jurisdiction of the accident site. If the probability exceeds the threshold of 20%, the physician dispatch system is activated. Since 2015, implementation of this system has covered around 4.2 million vehicles, accounting for 7% of the 60 million passenger cars in Japan.

**Results:** To date, over 9,000 automatic reports have been received, resulting in physician dispatches via doctor helicopters and doctor cars. The system has facilitated the provision of medical care up to 29 min faster (65→36min.) for patients with conditions such as tension pneumothorax and intra-abdominal bleeding, thereby saving numerous lives.

**Discussion:** A trial operation of the second version of DCN has begun, in which pre- and post-accident video information from inside and outside the accident vehicle is also transmitted. This has the potential to save the lives of vulnerable road users (e.g., pedestrians and cyclists) and elucidate the realities of accidents preceded by conditions such as consciousness disorders due to intrinsic diseases.



Oral Papers IID: Trauma Education Paper 73 - 78

Paper 73: 3:45 PM – 3:55 PM

**HUMANITY & TRAUMA ABOVE ALL - BUILDING  
BRIDGES THROUGH ADVANCED TRAUMA LIFE  
SUPPORT (ATLS) COURSES FOR PALESTINIAN &  
ISRAELI PHYSICIANS**

Adam Lee Goldstein, MD

Invited Moderator: Atsushi Nanashima, MD

**Introduction & Aim:** Working together is a fundamental tenet of improving outcomes for trauma victims. Advanced Trauma Life Support (ATLS) constitutes the foundation to optimize this care, and serves as a common language between providers. ATLS embodies the principles of teamwork, and therefore can facilitate respectable and sustainable partnerships between Palestinian and Israeli peers, while advancing trauma care. Methods: ATLS courses were conducted in equal groups of Palestinian and Israelis. A mixed method design study was conducted obtaining qualitative and quantitative data from a written survey and personal interviews. Results: One hundred and thirteen physicians participated in six courses, nineteen underwent in-depth interviews. In response to, what were your overall feelings about the course?, there was an average score of 9.1/10. Ninety-three percent of the participants answered 'yes' to wanting to maintain professional contact with their peers, and 63% said they would be interested in participating in social gatherings involving families. The interview responses showed that 95.6% felt the course had a positive benefit to their daily work. 82.4% had a positive response to cooperating and working together. 89.5% agreed that either of these groups face discrimination in their daily lives.

**Conclusion:** ATLS, and other similar initiatives that focus on teamwork and cooperation are ideal pathways to facilitate professional and personal relationships between Palestinians and Israelis. Such endeavors improve the treatment of trauma patients, advance the regional trauma system, and provide a framework for meaningful and sustainable relationships.

**MAINTAINING SURGICAL SKILLS IN AN ERA OF  
DECLINING TRAUMA SURGERY CASES: INSIGHTS  
FROM 12 YEARS OF TRAUMA SURGERY EXPERIENCE  
IN A SURGICAL RESIDENCY PROGRAM FACILITY**

Tadao Kubota, MD

Invited Moderator: Atsushi Nanashima, MD

**Background:** Unlike in Western countries, trauma center consolidation has not progressed in Japan. This raises the question of who the appropriate providers for the decreased number of trauma surgeries are. Emergency surgeons performing trauma surgeries lack sufficient cases for skill refinement, while on the other hand, surgeons performing elective surgeries face the dilemma of not being able to handle trauma across organs due to sub-specialization. In this context, our institution has deliberately not pursued sub-specialization, and has been addressing various trauma surgery cases by regularly handling a wide range of general surgery fields.

**Objective and Methods:** We examined the types, sites, target organs, and procedures of trauma surgeries performed under general anesthesia at our institution from April 2012 to December 2023. Additionally, we investigated the content and annual trends of non-trauma surgeries performed during the same period to assess the appropriateness of general surgeons handling trauma surgeries and to consider future sustainability.

**Results:** Trauma surgeries averaged around 6 cases per year, accounting for approximately 1% of the total surgeries performed. Most surgeries were related to abdominal organs, which could mostly be managed with techniques from the field of gastrointestinal surgery. Although there were fewer cases, it seemed possible to handle surgeries for neck, chest, and vascular trauma through routine clinical practice such as thyroid surgery, lung and mediastinal tumor surgeries, and peripheral vascular surgeries. Issues identified include a decrease in non-gastrointestinal cases as sub-specialization progresses, and an increasing proportion of laparoscopic surgeries leading to a rise in inexperienced young surgeons in open surgery.

**Conclusion:** Handling trauma surgeries with fewer cases seemed possible by broadly addressing the scope of general surgery in routine clinical practice. Moving forward, it is necessary to consider the training content and quantity required to maintain skills in surgeries of the neck, chest, blood vessels, and open thoracic and abdominal surgeries.

**A PRIMARY STUDY OF A SURGICAL TRAUMA COURSE  
ON ANIMAL MODELS IN MAINLAND CHINA**

Weiye Shi, MD

Invited Moderator: Atsushi Nanashima, MD

**Introduction:** The University of Hong Kong-Shenzhen Hospital (HKU-SZH) has developed a surgical trauma course that includes didactic lectures and practical sessions. During the operative session, surgeons were supposed to learn the principles of damage control surgery and treatment of specific organ injuries. The study aimed to assess the value of this course using participants' feedback and to investigate its future development.

**Materials & Methods:** The course curriculum consists of lectures and integrated operative practice on a live porcine model. 10 operating tables are fully equipped and participants performed all surgical procedures on a live animal model under general anesthesia. The surgical procedures are composed of penetrating trauma to the spleen, liver, small bowel, large bowel, diaphragm, lung, heart, inferior vena cava, iliac vessels, and aorta. Pelvic packing and temporary abdominal closure were taught as well. All procedures were ethical during the course. A questionnaire was sent to the 160 participants after completion of the course.

**Results:** We have held 6 courses since 2022 until now. Complete data were collected from 160 participants, who come from all over the country. Nearly all participants (158/160) reported they were satisfied with the course environment, structure, procedure, and content, and would like to attend this course next time. Splenectomy, cardiac, and aorta repair were the top three procedures they were interested in during the course. Approximately 98% of participants are prone to pass on the information and key materials they have learned at the course to colleagues and students at the home institutions. All of 160 participants preferred the course to be recommended to all regions in the country.

**Conclusion:** This primary study shows that operative trauma courses on animals significantly increased participants' ability to handle critically injured patients. This also indicates the benefits of this structured trauma training course not only in the short term but also in the long term goal. Moreover, we think that it is necessary to organize more training courses on large scale for specialized surgeons in mainland China.

## **APPLICABILITY OF A LOW-FIDELITY SIMULATOR TO LEARN EMERGENCY SURGICAL AIRWAY SKILLS IN MIDDLE-AND LOW-INCOME ENVIRONMENTS**

Felipe Vega-Rivera, MD

Invited Moderator: Atsushi Nanashima, MD

**Objective:** To show a simulator developed at the Center for Teaching and Research in Surgery (CEIC) of the Angeles Lomas Hospital in Mexico, for the surgical practice for emergency surgical airway skill training (surgical cricothyroidotomy and percutaneous cricothyroidotomy).

**Design:** Porcine tracheas were acquired that included the esophageal portion posteriorly and the complete thyroid cartilage. These were dissected and prepared in a special way so that they could be odorless and fresh for the practice, mounted on a rigid surface and covered with synthetic skin for the development of the skill.

**Method and survey:** During the ATLS courses in our setting from May 2022 to January 2024, we apply this simulator in the surgical airway skill station. We included all the students participating in ATLS, everyone had its own model to learn and practice the skill by itself following the instructor indications. At the end, all the participants fill a 6 questions survey that evaluates the similarity and applicability for emergency surgical skills at the simulator. In parallel, the model was shown to a group of ORL surgeons, so that they could give their opinion regarding the model's similarity and applicability for these skills.

**Results:** From May 2022 to January 2024 a total of 9 ATLS courses were taught in which more than 90 participants filled the questionnaire showing that almost the 90% thought that this simulator was ideal of very usefull in the emergency surgical airway skill training, from the ORL group 100% of them thought that this simulator was ideal / very usefull in the same skills training.

**Conclusions:** This is a low-cost, easily reproducible simulator that is considered extremely useful in developing and maintaining skills related to obtaining an emergency surgical airway.

# THE POWER OF MENTORSHIP: HOW TO RECRUIT AND RETAIN VALUABLE STAFF TO YOUR TRAUMA TEAM

Diane Wintz, MD

Invited Moderator: Atsushi Nanashima, MD

**Introduction:** Enthusiasm in healthcare careers has waned, becoming critically evident during COVID pandemic, which had tremendous impact on staff retainment and recruitment. The trauma team (nursing and surgeons) committed to fierce mentorship, which re-inspired interest in teaching and team building. The recipients of the mentorship were Healthcare Partners (HCPs), employees at nursing-assistant level who were assigned to the trauma room during their shifts. Because the team did not include residents, fellows, students or other trainees, the HCPs received real-life, up-close experience from experts in their area of employment.

**Methods:** HCPs with a minimum of 6 months experience in the general emergency department (ED) were eligible to interview for the trauma position. Most selected HCPs were identified as strong team members during their mandatory, minimum 6 months by nurses or other staff. The trauma nursing team at a single level 2 trauma center designed their training curriculum. The initial class of HCPs were trained and then took on the responsibility of training each new class prior to matriculation. HCPs were expected to participate in monthly team building activities, to achieve competence in multiple areas of active resuscitation, and to respond to a variety of emergent situations where surgeons or nurses required tech-level support. Data regarding each HCP's tenure as well as post-HCP career was tracked from 2017-2023 and reviewed to understand retainment.

**Results:** There were 194 HCPs who worked in the ED full time over the 7 years. Ninety HCPs were dedicated to trauma and received the trauma nursing curriculum (46%). More than 80% of the HCPs year-over-year retained their employment in the trauma position. Almost all HCPs (88/90; 98%) either went on to major healthcare or pre-hospital careers or continued to work in this same capacity in trauma to date. One HCP moved out of state and was not able to be tracked.

**Conclusion:** Recruitment is possible through job opportunities within the field of interest. Retainment is realistic if the opportunity matches the needs or incites motivation in the employee. We have designed an effective mentorship plan which accomplishes both goals and could be replicated in any healthcare system.

TRAUMA HCP FINAL HEALTH CAREERS:

Year	Total HCP	TRAUMA HCP continued into next year	NEW trauma HCP/yr	Doctor	Nurse	PA	Fire/PD	medic	Allied health	Other	HCP to date
2017	78	43		3	18	6	1	1	4	2	8
2018	76	43	9		6	3					
2019	61	36	6		2	1			1		2
2020	72	44	14	1	4		2		1		6
2021	73	45	7		3						3
2022	66	35	3		1		1				1
2023	78	31	8		2		1				4
TOTAL	504	277	47 (90 total)	4	36	10	5	1	6	2	24

Oral Papers IID: Trauma Education Paper 73 - 78

Paper 78: 4:35 PM – 4:45 PM

**SURGICAL RESIDENCY TRAINING INNOVATIVE  
CURRICULUM IN TRAUMA**

Nancy Lopez, MD

Invited Moderator: Atsushi Nanashima, MD

Training general surgery residents to excel in trauma activations and overall healthcare of trauma patients requires innovative curriculums. A collegial learning environment is fundamental as well as continuous assessment of resident progress. The objective of this curriculum is to train future surgeons to take care of trauma patients in a safe manner in a collegial learning environment with continuous reassessment of the progress, with the goal of fostering leadership, independent critical thinking skills, and procedural skills amongst surgical residents. New surgical residents introduced to trauma will require training before taking care of patients, a graduated curriculum created to enhance resident's performance during 5 years of residency and a monitoring tool to assess performance annually via the use of redcap to record evaluation sheets and to compare progression. Secondary goal includes empowering surgical residents become teachers to more junior residents and medical students.

WITHDRAWN

WITHDRAWN



**MODERATE TO SEVERE TRAUMATIC BRAIN INJURY  
OUTCOMES - A TWENTY YEAR LONGITUDINAL  
COHORT ANALYSIS**

Yuewei Xiao, MD

Invited Moderator: John Agapian, MD

**Objectives:** Although recognised as a leading cause of death and disability, it is unclear whether current treatment strategies have improved outcomes from blunt moderate to severe traumatic brain injuries (msTBI) due to a lack of available epidemiological data. This study sought to determine if in-hospital mortality and early functional outcomes of msTBI patients have changed over 20 years. Early functional outcomes were determined through the surrogate measure of the proportion of patients discharged directly to home.

**Methods:** This is a longitudinal cohort study with analyses of The Alfred Health Trauma Registry data between 1 January 2002 to 31 December 2021. Subjects were adults aged 16-70 years with blunt msTBI (Head Abbreviated Injury Scale AIS = 3-5) admitted to The Alfred Hospital Trauma Service - the largest major trauma service in Australia. Logistic regressions were used to determine mortality and discharge destination trends, as well as for subgroup mortality trends. A multivariable logistic regression model was used to assess trends in mortality outcomes, adjusting for changes to the injury severity of presentations over the period.

**Results:** A total of 8,222 subjects presented with msTBI over the 20 years, with 692 total deaths. The unadjusted in-hospital mortality rate declined significantly, from 12% in 2002 to 4% in 2021 (OR 0.96, 95% CI 0.95-0.97, p less than 0.001). Odds of death per annum remained the same after adjusting for changes to the injury severity of presentations (OR 0.96, 95% CI 0.93-0.99, p less than 0.001). The greatest improvements in mortality were seen in the oldest subpopulations (ages 50-70; 0.45% p.a. mean mortality reduction, p less than 0.001) and in those with the most severe head injuries (head AIS = 5; 0.6% p.a. mean mortality reduction, p less than 0.001). The proportion of subjects discharged to home increased from 31% to 61% over the period (OR 1.05, 95% CI 1.04-1.06, p less than 0.001).

**Conclusions:** Changes in neurotrauma care in Victoria (Australia) and The Alfred Hospital in the first two decades of the century have been associated with a marked reduction in mortality. These results foster optimism for the care of patients with moderate to severe brain injuries and support further innovations and investigations in neurotrauma care.

**RETROSPECTIVE VALIDATION OF THE BRAIN INJURY  
GUIDELINES: MANAGEMENT OF TRAUMATIC BRAIN  
INJURY AT A SINGLE COMMUNITY TRAUMA ONE  
HOSPITAL**

Gianmarino Gianfrate, MD

Invited Moderator: John Agapian, MD

Traumatic brain injury (TBI) can lead to widespread devastating effects on the individual and the medical community. The incidence of traumatic brain injury has been on the rise since the early 2000s, up 20-30% since that time. The Brain Injury Guideline (BIG) Project 2013 set forth by the University of Arizona attempted to set specific guidelines for non-operative management and the necessity of neurosurgery evaluation for TBI. Today, the increased incidence of TBI and the use of oral anticoagulation have led to a major tax on medical resources.

In our retrospective cohort analysis, we explored all 121 traumatic brain injuries that were presented to St. Elizabeth Youngstown Hospital, a level I trauma center, in Youngstown, Ohio. Patients were classified according to neurologic examination results, CT imaging, use of intoxicants, tertiary neurological exam, and anticoagulation status. We then verified and cross-referenced our cohort with the already developed brain imaging guidelines for individual patients' need for observation, hospitalization, or neurosurgical consultation. Patients discharged had a follow-up neurosurgical evaluation 3-4 weeks after leaving the hospital.

80 patients had an abnormal head CT finding. In the BIG 1 category, all patients had a stable or improving repeat CT head scan at 4 hours, did not require intervention, had a normal inpatient and outpatient neurosurgical evaluation, and had a GCS of 15 on tertiary exam and before discharge. Patients within the BIG 2 category had worsening bleeds 16% of the time, but all were stable on 3rd CT scan. All BIG 3 patients required prolonged hospital stays with an all-cause mortality of 17%.

Without the resources of many larger institutions, regional and community trauma centers can rely on this guideline to help create an algorithm to streamline patient care. This can allow the limited resources to aid in other aspects of patient care. Using the criteria set forth by the BIG project in 2013, along with our institutional guidelines, we were able to authenticate a non-admission protocol for TBI. We believe this will aid in changing our current practice management guidelines that will support patient care and help distribute the demand for medical resources.

## EPIDEMIOLOGY OF TRAUMATIC ATLANTOOCIPITAL DISLOCATION: NATIONAL REGISTRY STUDY

Kristin Salottolo, MD

Invited Moderator: John Agapian, MD

**Introduction:** Traumatic atlantooccipital dislocation (TAOD) is extremely rare and often considered fatal. We sought to describe the epidemiology, management, and outcomes of TAOD using a large National registry.

**Methods:** Patients with TAOD were identified from the National Trauma Data Bank (2017-2019) using ICD-10 diagnosis codes (S13.11); there were no exclusions. Chi-square tests were used to compare variables associated with mortality, which was examined as death in the emergency department (ED), death after admission, and survival to discharge. Multivariate logistic regression with backward selection was used to identify associations of surgical management, with either cervical fusion or internal fixation, for admitted patients. Significance was  $\alpha=0.05$ .

**Results:** Overall, 0.1% ( $n=2,729$ ) of trauma patients had TAOD. The median age was 37 (21-61) years, most (63%) patients presented with ED GCS 3-8, and most (55%) injuries were due to motor vehicle collision (MVC). Half ( $n=1,153$ ) of patients survived, with 50% ( $n=564$ ) of deaths occurring in the ED and 50% ( $n=572$ ) after admission. Patients who survived were more likely to be older,

white, injured from falls, to have a concomitant C1 or C2 fracture or transverse ligament injury, and less likely to have polytrauma (ISS $\geq$ 25), an ED GCS 3-8, and a TBI (Table 1). The rate of surgical

management was 32%. Variables that increased odds of surgery were transverse ligament injury (OR: 3.1 [2.3-4.0]), C2 axis fracture (OR: 2.2 [1.6-3.1]), an MVC injury (OR: 2.2 [1.4-3.7]) or pedestrian auto accident (OR: 2.0 [1.1-3.6]) vs. ground-level fall, age 18-65 (OR: 1.4 [1.3-2.4] vs. under 18 years), and treatment at a level I trauma center (OR: 1.5 [1.1-1.9]), whereas there were decreased odds of surgery with ED GCS 3-8 (OR: 0.7 [0.5-0.9]) and ED hypotension (OR: 0.44 [0.3-0.6] vs. SBP >90mmHg). Survival was greater with surgical vs. nonoperative management (95% vs. 54%).

**Conclusion:** TAOD was rare and devastating, resulting in 50% mortality. However, nearly all patients who were surgically stabilized survived. Patients with high mechanism injuries, concomitant upper cervical injuries, and stable vital signs were more likely to be surgically managed.

**Table 1.** Association with survival for patients with Traumatic atlantooccipital dislocation (TAOD,  $n=2,729$ )

Characteristic	Died in the ED (564, 24.6%)	Died after admission ( $n=572$ , 25.0%)	Survived to discharge ( $n=1153$ , 50.4%)	p value
<b>Demographics</b>				
Age < 18	11.5%	23.6%	19.1%	
Age 18-64	75.4%	58.4%	54.7%	
Age $\geq$ 65	13.1%	18.0%	26.2%	<b>&lt;0.001</b>
Male sex	63.1%	62.2%	62.6%	0.95
Non-hispanic white	52.0%	63.5%	68.7%	<b>&lt;0.001</b>
<b>Cause of injury</b>				<b>&lt;0.001</b>
Motor vehicle collision	54.6%	60.5%	52.2%	
Pedestrian transport accident	30.3%	21.3%	9.2%	
Fall from height	3.6%	5.9%	15.3%	
Ground level fall	0.2%	2.5%	13.2%	
Other causes ( $\leq$ 3% each)	11.4%	9.8%	10.1%	
<b>Injury severity</b>				
Polytrauma (ISS $\geq$ 25)	82.8%	82.9%	32.8%	<b>&lt;0.001</b>
ED Glasgow coma score 3-8	98.4%	89.9%	32.4%	<b>&lt;0.001</b>
ED hypotension (<90mmHg)	89.7%	38.6%	6.9%	<b>&lt;0.001</b>
<b>Concomitant diagnoses</b>				
Traumatic brain injury	85.8%	85.0%	44.7%	<b>&lt;0.001</b>
Transverse ligament injury	1.4%	10.8%	25.1%	<b>&lt;0.001</b>
C1 (atlas) fracture	7.5%	17.3%	23.2%	<b>&lt;0.001</b>
C2 (axis) fracture	4.3%	13.1%	21.0%	<b>&lt;0.001</b>
<b>Stabilization procedures</b>				
Surgical (fusion, fixation)	0.0%	4.9%	45.5%	<b>&lt;0.001</b>
Non-surgical (halo, traction, c-collar)	1.1%	9.6%	11.5%	<b>&lt;0.001</b>

**DIFFERENTIAL IMPACT OF RACE ON TRAUMATIC  
INTRACEREBRAL HEMORRHAGE INCIDENCE AND  
OUTCOMES**

Erica Romo, MD

Invited Moderator: John Agapian, MD

**Objective:** To identify racial disparities in traumatic intracranial hemorrhage (tICH) etiology and outcomes to enhance prevention strategies.

**Methods:** This retrospective cohort study analyzed tICH cases among patients admitted to six US level I and II trauma centers between January 2016 and July 2022. Racial categories included Hispanic, Non-Hispanic (NH) White, NH Black, NH Asian American or Pacific Islander (AAPI), American Indian/Alaska Native (AIAN), and NH-Other. Mechanisms of injury (MOI) were classified as penetrating injury (PI), motor vehicle collision (MVC), fall from height (FFH), and ground level fall (GLF). Chi-square tests assessed racial differences in tICH incidence, MOI, substance use, comorbidities, and outcomes.

**Results:** Among 73,546 trauma admissions, tICH occurred in 12,674 cases (17%), with the highest incidence in AAPI/AIAN patients (24%) and the lowest in Black patients (15%) ( $p < 0.001$ ). NH White patients had the highest percentage of individuals over 65 (58.5%), while those under 21 were more prevalent among NH Black and Hispanic groups (6.8% and 6.0%, respectively). NH White patients were more likely to use anticoagulants (16.5%), while AAPI/AIAN individuals exhibited a higher prevalence of dementia (12.3%). NH Black patients had the highest rate of positive toxicology results (50.4%), while Hispanic patients showed the highest prevalence of alcohol levels above 0.08 (40%). FFH was the most common MOI among NH White and AAPI/AIAN patients (43.2% and 43.4%, respectively), whereas penetrating injuries were most common among NH Black patients (10.5%). MVC-related tICH was more frequent in NH Black patients (34.4%), while FFH predominated in counterpart groups. Inpatient mortality accounted for 48% of all trauma fatalities, with no significant difference observed by race ( $p = 0.11$ ).

**Conclusion:** Traumatic intracerebral hemorrhages account for a large proportion of deaths in trauma admissions. Although mortality does not differ by race, our study reveals significant racial disparities in traumatic intracerebral hemorrhage (tICH) incidence, mechanisms of injury and predisposing features such as comorbidities, age, and substance use. Tailored prevention strategies and interventions are warranted to address these variations and improve outcomes across diverse racial groups affected by tICH.

Paper 85: 1:40 PM – 1:50 PM

**ASSESSING THE IMPACT OF THORACIC  
ENDOVASCULAR AORTIC REPAIR ON DELAYED  
NEUROLOGICAL DETERIORATION IN PATIENTS WITH  
BLUNT AORTIC INJURY AND TRAUMATIC BRAIN  
INJURY: A TQIP STUDY**

Chih-Yuan Fu, MD

Invited Moderator: John Agapian, MD

**Introduction:** Blunt aortic injury (BAI) is recognized as a lethal, high-energy impact trauma often accompanied by other concomitant injuries. Although Thoracic Endovascular Aortic Repair (TEVAR) is frequently employed to address aortic injuries, reports indicate hemorrhagic complications associated with vascular intervention. This study aims to assess whether TEVAR is linked to delayed neurological deteriorations in patients with concurrent BAI and traumatic brain injury (TBI).

**Methods:** This study utilized the Trauma Quality Improvement Program (TQIP) dataset from 2022, focusing on patients with both BAI and TBI. Propensity score matching (PSM) was employed to eliminate baseline discrepancies between patients undergoing TEVAR and those who did not. Defined outcomes, specifically delayed neurological deterioration, were compared in these two groups after achieving a well-balanced PSM. Additionally, a multivariate logistic regression (MLR) analysis was conducted to identify independent factors contributing to delayed neurological deterioration in patients with concurrent BAI and TBI.

**Results:** The study included a total of 785 patients, with 147 patients undergoing TEVAR (18.7%) for BAI, and 13 (8.8%) experiencing delayed neurological deterioration post-TEVAR. Following a well-balanced 1:1 PSM (N=147), there was no significant difference in the probability of delayed neurological deterioration between patients undergoing TEVAR for BAI (7.5% vs. 8.1%,  $p=0.223$ ). The MLR analysis indicated that TEVAR did not significantly elevate the probability of delayed neurological deterioration among patients with concurrent BAI and TBI (odds=1.07,  $p=0.355$ ). Conversely, the abbreviated injury scale of the chest emerged as an independent factor influencing delayed neurological deterioration.

**Conclusion:** The study did not observe a higher probability of delayed neurological deterioration in patients undergoing TEVAR. Therefore, TEVAR can be performed in patients with concurrent BAI and TBI without a significantly heightened risk of delayed neurological deterioration.

## **BULL HORN INJURY- EMERGING PROBLEM OF URBAN INDIA: A CASE SERIES ANALYSIS FROM A LEVEL 1 TRAUMA CENTRE**

Anita Singh, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** In different parts of the world, cattle afflicted injuries are witnessed only in areas where cattle farming is prevalent or in countries like Spain where bullfighting is a seasonal sport. But in the Indian sub-continent, these injuries are common throughout the year and are also seen in urban areas due to high prevalence of cattle farming. These animals usually cause injuries that have different characteristics such as large area of tissue damage, creation of cavities, twists and inoculation of aerobic and anaerobic bacteria. The injury patterns can present as variety of bizarre and complex wounds.

**Methodology:** A case series analysis of the patients admitted after sustaining bull horn injury to our Level 1 trauma centre was conducted over a span of 7 years. Their epidemiological parameters, injuries, management and outcomes were noted. We also classified these injuries in to primary, secondary, tertiary and quaternary which is not yet available in literature.

**Results:** 501 patients were admitted during the 7-year duration. The mean age was 47.9 years with a male: female ratio of 3.47:1. Most common mechanism of injury was with a combination of direct and indirect impact by the bull or its horns (54.3%). Majority patients were from rural areas (75.4%). The most common injuries were thoracic injuries in 47.8 % patients followed by abdominal (38.6%) and perineal injuries (8.3%). 193 (38.5%) patients were

conservatively managed but 308 (61.5%) patients required major interventions.

### **Conclusion:**

Bull horn injuries are major cause of mortality and morbidity in developing world due to un-regularized farming structure.

Shelter homes

are needed to prevent them from wandering on roads and being cause of major RTI. We should understand the specific mechanism and pattern of these injuries with classification for better and specific management to reduce mortality. All types of bull horn injuries are needed to be reported to know exact incidence and prevalence. With strict regulations and precautions most of these injuries can be prevented.



**THE SIGNIFICANCE OF EARLY ARTERIAL-PHASIC IN  
MULTIDETECTOR CT FOR BLUNT SPLEEN INJURED  
PATIENTS: A CLINICAL OUTCOMES-ORIENTED STUDY**

Yu-Hao Wang, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Blunt spleen injuries (BSI) present a significant diagnostic and management challenge in trauma care. Current guidelines recommend arterial phase contrast-enhanced multidetector computed tomography (CT) for detailed assessment. However, the optimal imaging phase for predicting clinical outcomes remains debatable. "This study investigates the impact of arterial-phasic imaging via multidetector CT in the early diagnosis (within the first 24 hours) and clinical outcomes of patients with blunt spleen injuries."

**Method:** A retrospective case-control study was conducted, analyzing data from adult patients with BSI treated at a single institution from 2019 to 2022. Patients were divided based on the CT phase performed—portal vein phase only, or with add-on arterial phase. Data collected included demographics, injury severity, spleen injury grade, and management outcomes. Employing Inverse Probability Treatment Weighting (IPTW) for group comparison.

**Result:** Of 170 patients assessed, 147 met the inclusion criteria and were divided into two groups: those receiving portal vein phasic-only CT (N=104) and those with add-on arterial phasic CT (N=43). The overall non-operative management (NOM) failure rate was 3.0% (4/132), the NOM-Observation (NOM-OBS) failure rate was 6.7% (4/60), and the spleen artery embolization (SAE) failure rate was 4.1% (3/73). After adjusting for covariates using inverse probability of treatment weighting (IPTW), the comparison between the add-on arterial phase and portal phase CT groups revealed similar overall NOM failure rates (3.0% vs. 2.2%, p-value: 0.721), NOM-OBS failure rates (3.8% vs. 6.2%, p-value: 0.703), and intra-abdominal bleeding-related mortality rates (4.8% vs. 2.1%, p-value: 0.335). Among the 43 patients who underwent an add-on arterial CT, only one was diagnosed with a tiny pseudoaneurysm attributable to the inclusion of the arterial phase."

**Conclusion:** Early dual-phase CT within 24 hours of presentation offers no added value over single-phase CT in managing blunt spleen injuries regarding clinical outcomes. Further research is needed to define the role of follow-up enhanced CT in this patient population.

**CONCEALED PERIL: INFLUENCE OF SOLID ORGAN  
TRAUMA ON MESENTERIC INJURY DETECTION AND  
THE ROLE OF HEMODYNAMICS**

Yauren Chang, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Prompt detection and management of bowel and mesenteric injuries after blunt abdominal trauma are vital to reduce patient morbidity and mortality. We hypothesize that mesenteric injury combined with solid organ injury is associated with delayed surgical exploration.

**Methods:** A retrospective review from 2009 to 2023 identified patients with traumatic mesenteric injury in our hospital. Exclusions were penetrating trauma, patients under 18, no surgical intervention, and AIS head score more than or equal to 3. Our primary outcomes were overall survival and time from ED arrival to the OR. Delayed surgical exploration was defined as over 12 hours from ED to OR, and complicated mesenteric injury involved concurrent liver/spleen injury. Hemodynamic stability was determined by an SBP threshold of 90mmHg.

**Results:** Of 403 patients with mesenteric injury, 232 were analyzed. The average overall survival (OS) was 89.7%, with a mean time of 6.4 hours from ED to OR. Delayed surgical exploration was linked to longer hospital stays (25.0 vs. 15.8 days,  $p=0.011$ ) but did not significantly alter OS (100% vs 88.5%,  $p=0.142$ ). In hemodynamically stable patients ( $n=189$ ), complicated injuries correlated with lower GCS (12.9 vs. 14.2,  $p=0.022$ ), higher heart rate (104.2 vs. 96.3 bpm,  $p=0.032$ ), and higher ISS (18.6 vs. 14.9,  $p=0.023$ ), with no significant differences in OS (91.5% vs. 93.7%,  $p=0.739$ ) or delayed surgery rates (10.6% vs. 11.3%,  $p=1.000$ ). Conversely, in hemodynamically unstable patients ( $n=43$ ), complicated mesenteric injuries had more delayed surgeries (25.0% vs. 0.0%,  $p=0.031$ ), higher heart rates (118.4 vs. 93.1 bpm,  $p=0.036$ ), and longer hospital stays (13.8 vs. 8.6 days,  $p=0.043$ ), without impacting OS (75.0% vs. 74.3%,  $p=1.000$ ).

**Conclusion:** In an unstable hemodynamic context, patients with complicated mesenteric injuries are at a higher risk for delayed surgical exploration, which may be associated with adverse outcomes. Such a risk is not evident in hemodynamically stable patients, emphasizing the importance of identifying concealed mesenteric injury and hemodynamic stability in the management of these injuries.



**PROGNOSTIC FACTORS IN THE MANAGEMENT OF  
BLUNT ABDOMINAL TRAUMA. OUR EXPERIENCE IN A  
TERTIARY TRAUMA CENTER**

Agron Dogjani, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Blunt abdominal trauma poses a significant challenge in the healthcare landscape, contributing substantially to morbidity and mortality across all age groups. The complex nature of intra-abdominal injuries often makes their identification and management a daunting task, as certain injuries may not immediately manifest during the initial assessment and treatment phase.

Prognostic factors play a crucial role in predicting outcomes and guiding the management of these patients. Here are key aspects to consider:

In Assessment as: Primary Survey: Secondary Survey: Imaging Studies:  
Laboratory Tests:

Prognostic Factors as: Hemodynamic Stability: Injury Severity Score (ISS):  
Specific Organ Injuries:

The severity of organ injuries influences prognosis; Age and Comorbidities:  
Time to Intervention: Associated Injuries: Presence of injuries to other body  
regions can complicate the overall management; Serial Examinations:

In Management as: Observation: Operative management: Non-operative  
Management: Intensive Care Monitoring: Pain Management and Supportive  
Care...

**Material and Methods:** Conducted at a unit center from December 2021 to  
December 2023, our study focused on 240 patients who presented at the  
University Hospital of Trauma (UHT) in Tirana, Albania.

The analysis employed the Kendal's tau correlation coefficient to explore  
relationships between various variables. Data were meticulously presented  
through tables and diverse charts. Statistical significance was determined with p  
values <0.05 (or 5%)...

**Results:** The outcomes of trauma treatment appear to be intricately linked to  
several factors, including hemodynamic status, patient age, mechanism of  
trauma, and the duration between trauma occurrence and hospital presentation.  
These findings underscore the importance of a nuanced approach to trauma  
management, emphasizing the need for tailored interventions based on  
individual patient characteristics.

**A RETROSPECTIVE ANALYSIS OF PENETRATING STAB  
ABDOMINAL INJURY AND MANAGEMENT: A SINGLE  
INSTITUTIONAL EXPERIENCE**

Narendra Kumar, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Penetrating stab abdominal injury is often a life-threatening condition, which is mainly associated with inflicted injuries and most of the victims being young aged. The most common organs injured are the small bowel (50%), large bowel (40%), liver (30%), and intra-abdominal vascular (8%). The diagnosis and management of penetrating injury has been drastically changes over past decades.

**Aim:** To understand the management of these patients to minimize the rate of negative laparotomy, morbidity and mortality.

**Material and methods:** A six-year duration retrospective study of 140 patients with penetrating stab abdominal injury at the King George Medical University, Lucknow (India).

**Result:** Total 140 patient admitted during the 6-year duration who sustained abdominal stab injury. The mean age was 35 years with male: female ratio of 10:1. Homicidal injuries are accounted for most of injuries 92.3%. Eighty-six in 140 (61.42%) patient undergoes exploratory laparotomy and in which procedure was therapeutic in 73.4% and in 26.6% non-therapeutic. Fifty-four in 140 (38.57%) patients managed non operatively.

**Conclusion:** Management of these patients is based on individuals' nature of injury, findings at presentation and organs involved. Majority of penetrating abdominal stab injury patients can be non-operatively with newer diagnostic modalities and clinical examination. These newer investigation modalities minimize the rate of negative laparotomy and mortality of patients. Diagnostic laparoscopy is a new modality in trauma which is useful in stable patient. It decreases patient hospital stay, unnecessary scar and surgical site infection.

**UNDERSTANDING HOSPITAL LENGTH OF STAY IN  
TRAUMA LAPAROTOMY PATIENTS: A NATIONAL  
TRAUMA DATABASE STUDY.**

Hayaki Uchino, MD

Invited Moderator: Amanda Teichman, MD

**Background:** Trauma laparotomy is a common surgical procedure for both blunt and penetrating abdominal trauma, encompassing interventions ranging from addressing injured abdominal organs, including life-threatening bleeding, to exploratory diagnostic procedures. The diverse range of patient conditions requiring trauma laparotomy leads to significant variability in hospital length of stay (LOS), posing challenges for effective patient care planning. This study aimed to determine factors associated with LOS in patients undergoing trauma laparotomy.

**Methods:** A retrospective analysis was performed using the National Trauma Data Bank from 2017 to 2019. Patients who underwent trauma laparotomy were identified based on ICD-10 codes and abbreviated injury scores. LOS was categorized into 3 groups (short 5 days, medium 5 to 11 days, long > 11 days). Tests for differences were employed to assess statistical differences between patients across each LOS group.

**Results:** A total of 27,434 trauma laparotomy patients were identified. The overall median LOS was 7.0 [5.0, 11.0] days. Laparotomy for hemorrhage control was performed in 9.9% of patients in the short LOS group, 22.5% in the medium LOS group, and 41.7% in the long LOS group. Patients in the long LOS group were more frequently treated at university hospitals and had a higher prevalence of being discharged to post-acute care facilities than home. Factors positively associated with short LOS ( 5 days) included self-inflicted injuries (vs. unintentional), penetrating mechanisms (vs. blunt), isolated abdominal trauma (vs. polytraumas), diagnosis of superficial wounds, and abdominal cavity surgeries (e.g., exploratory laparotomy). Conversely, factors positively associated with long LOS (> 11 days) were mechanisms such as falls, motor vehicle-related injuries, and gunshot wounds (vs. stab wounds), obesity (vs. normal weight), Medicare coverage (vs Medicaid), comorbid conditions, higher Injury Severity Score, transfusions, and injuries to major vessels and the pancreas.

**Conclusion:** This study identified factors associated with hospital LOS in patients undergoing trauma laparotomy. Understanding these factors holds the potential to introduce comprehensive targeted approaches, including pathway implementation, early discharge planning, and timely access to post-acute care, which may be particularly valuable in the current era of constrained healthcare resources.

## THE UTILITY OF SEQUENTIAL HEPATECTOMY FOR HIGH-GRADE LIVER TRAUMA: A CASE SERIES

Hirotaka Yamamoto, MD

Invited Moderator: Amanda Teichman, MD

**Background:** Damage control surgery (DCS) with or without adjunctive hepatic artery embolization is often performed during the initial operation in patients who sustain complex liver injuries with hemodynamic instability. However, extensive liver necrosis and a refractory biliary leak may require multiple percutaneous or endoscopic interventions and lead to increased liver-related morbidity and mortality. The purpose of this study is to present high-grade liver injury cases successfully treated by anatomical liver resection after the initial DCS or hepatic artery embolization and to reconsider the utility of sequential hepatectomy in complex liver trauma.

**Methods:** We retrospectively reviewed the medical records for all liver injury patients admitted to our hospital from January 2013 to December 2023. A total of 48 patients were identified. Of those, 11 patients were diagnosed with high-grade blunt liver injuries (AAST Grade III-V). The treatment modality and clinical outcome were explored.

**Results:** Of the 11 patients, 3 patients were managed with anatomical liver resection (hepatectomy group), and 8 patients were managed non-operatively (NOM group). Two patients in the hepatectomy group initially underwent DCS with perihepatic packing followed by hepatic artery embolization. Both patients had extensive injury to the hepatic right lobe complicated by biliary leak confirmed on cholangiography. Right hepatectomy was performed on post-injury day 7 and day 6, respectively. The third patient in the hepatectomy group was transferred from a local hospital for the management of liver injury. Vital signs were stable, but the computer tomography scan revealed extensive damage to the right lobe of the liver, along with a contrast blush extending to the peritoneal cavity. The patient underwent emergent hepatic artery embolization, and extended posterior-segmentectomy was performed on post-injury day 1. All 3 hepatectomy patients survived to the hospital discharge, and there were no liver-related complications. In comparison, the overall mortality and liver-related complication rate in the NOM group was 12.5% and 62.5%, respectively.

**Conclusion:** Our data suggest that anatomical liver resection during an early post-injury period can mitigate the risk of liver injury-related complications.

**DEVELOPING VIRTUAL REALITY EDUCATION OF  
INTRAABDOMINAL HEMORRHAGIC DAMAGE  
CONTROL SURGERY FOR YOUNG SURGEONS AND  
MEDICAL STUDENTS**

Atsushi Nanashima, MD

Invited Moderator: Amanda Teichman, MD

The field of operative simulation systems using the latest computerized technology has witnessed significant advancements in the past two decades. Notably, the use of three-dimensional (3D) angiographic images from contrast-enhanced computed tomography (CT) has revolutionized surgical simulation and navigation, greatly enhancing the safety of surgical procedures. Recently, extended or cross-reality (XR) technology, such as virtual reality (VR) and augmented reality, has found applications in the field of surgery. To develop a VR platform for digestive surgery education with reasonable costs, We developed a prototype VR platform, VECTORS L&M (VLM), aiming to enhance the understanding of general surgery for students, interns, and young surgeons. The camera settings of the LUMIX GH5S were ISO 320, shutter speed 4000, anamorphic 3.3K, and 59.94 fps. The data captured using the Insta360 Pro2 camera was processed and converted into a 360-degree video. The operating field using the Insta360 Pro2 camera was used to convert the LUMIX footage into VR video format efficacy. The VLM provides four surgical contents including damage control surgical VR views from both 180-degree angles. The patient received traffic accidents and had a severe intraabdominal hemorrhage by liver laceration. Of the hemorrhagic shock with deadly triad, the patient underwent a damage control operation at the emergency room and a surgeon took an entire video with the wearable camera. This video was created with L.A.B. Co., and incorporates a virtual video. Twenty-eight participants and twenty students responded to our survey regarding trauma surgery. A majority (81%) reported positive experiences reality with the VR content and well-understood search for bleeding sources, Pringle's maneuver, and the adequate gauze-packing procedure under damage control surgery in comparison to classroom lectures. VR may be preferred over a fixed 2D video. Participants expressed the desire for future VR improvements, such as increased mobility, cloud connectivity, cost reduction, and better resolution. The VLM platform, coupled with this innovative teaching approach, offers experiential learning in intraabdominal trauma surgery, effectively enriching the knowledge of students and surgeons ahead of surgical education and training.

**LIVER INJURY WITH BLEEDING FROM EXTRAHEPATIC  
COLLATERAL VESSELS ONLY: CASE SERIES.**

Natsuki Hashiba, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Extrahepatic collateral arteries (EHAs) are clinically important when performing transarterial chemoembolization (TACE) of hepatocellular carcinoma (HCC). This is because blood flow from various arteries around liver to HCC is increased. Development of collateral arteries is related to size and location of tumor, and previous TACE or surgery. We report three very rare cases of liver injury with bleeding from EHAs only.

**Case 1:** 29-year-old male. He had a Grade IV liver injury in the posterior segment. Angiographic examination from the posterior hepatic branch showed no bleeding. Examination of the right inferior phrenic artery revealed extravasation, and embolization was performed.

**Case 2:** 67-year-old male. Hepatic injury was observed in dorsal caudal area of the anterior and medial segment with extravasation and a pseudaneurysm. There was no extravasation from the medial segment branch, and bleeding was detected only from the cholecystic artery.

**Case 3:** 43-year-old male. Hepatic injury was observed in cranial area of the medial segment, and no extravasation was seen from the left hepatic artery or the right inferior phrenic artery. Examination of the right internal thoracic artery revealed a pseudoaneurysm.

**Discussion:** All patients, with no history of liver disease, had blunt trauma due to traffic accident, and their intra-abdominal organ injury was only liver. The presence of intra-abdominal hemorrhage suggested rupture of liver capsule. However, angiography from hepatic arterial system showed no extravasation. Only studies from EHAs, which was assumed from respective injury site, showed extravasation, and hemostasis was successfully achieved in all cases. Injuries of EHAs could be caused by traction force applied to the fixed area of liver. Spontaneous hemostasis is not expected since there is no surrounding tissue or organ that could give compression. In particular, bare area, and segment IV, V and medial dorsal segment VI are the most frequently reported sites of collateral bleeding in HCC, and this knowledge is useful in liver injuries occurring in these areas.

**Conclusion:** Even though extravasation from hepatic artery is not detected during angiography, possible bleeding from EHAs should be considered especially when damaged site on contrast-enhanced CT is observed in the specific areas.

# ANGIOEMBOLIZATION IN THE MANAGEMENT OF ABDOMINOPELVIC INJURIES: A 2-YEAR CASE SERIES AND EARLY EXPERIENCE FROM A MAJOR TRAUMA CENTER IN THE PHILIPPINES

Delbrynth Smigel, Rene Ogatis, MD

Invited Moderator: Amanda Teichman, MD

**Introduction:** Angioembolization (AE) plays a crucial role in the management of trauma by providing an effective and minimally invasive approach to treat abdominal solid organ and pelvic injuries. While it has been widely utilized in developed countries worldwide, there is paucity of data with the role of AE in the Philippines because of lack of accessibility to infrastructure, equipment, and skilled personnel in all of the identified trauma centers nationwide.

**Methods:** All patients with AIS  $\geq 3$  injuries in the liver, spleen, kidney, and pelvis, who underwent AE at our institution from April 2022 to March 2024, were included in the study. The patients' demographic data, clinical presentation, imaging and intraoperative findings, and outcomes were collected.

**Results:** There were 16 patients included in the study. The median age was 29.5 years and 13 (81.3%) patients were males. 6 (37.5%) of the patients presented with hemodynamic instability at the emergency department. The main cause of injury was blunt trauma in 15 (93.8%) patients. The most common indication of AE was presence of active bleeding on CT scan. The most common injury was in the liver (37.5%), followed by the spleen (31.3%), kidney (18.8%), and the pelvis (18.8%). Of the 13 patients who had solid organ injuries, 9 (69.2%) were managed conservatively followed by AE. No failure of nonoperative management was documented. Moreover, 4/13 (30.8%) patients underwent damage control laparotomy followed by AE, wherein 3 had closure on the second surgery while 1 died due to cardiogenic shock on the 7th hospital day prior to third surgery. All patients who had pelvic injuries underwent AE prior to external fixation, with one case complicated by acute limb ischemia. Median hospital length of stay was 17 days for all patients.

**Conclusion:** Our data, though limited, exemplifies the significance of the utility of advanced interventional techniques in trauma care. Given the numerous studies reporting improvement of

outcomes when used as an adjunct to treatment approach, AE should be made available in all identified trauma centers throughout the country.

Profile of patients who underwent angioembolization from April 2022–March 2024

Patient	Age/Sex	Mechanism of Injury	Hemodynamic Status	Grading of Injured Organ that had AE	Management	Complications	HLOS in days	Outcome
1	17/M	B	Stable	Grade IV spleen	NOM + AE	None	17	Discharged
2	11/M	B	Stable	Grade IV kidney	NOM + AE	None	7	Discharged
3	62/M	B	Stable	Grade III spleen	NOM + AE	HAP	20	Discharged
4	20/M	B	Stable	Grade IV spleen	NOM + AE	None	20	Discharged
5	34/F	B	Unstable	Pelvic injury	AE + EF	Acute limb ischemia	62	Discharged
6	26/M	P	Unstable	Grade III liver	DCL + AE	None	19	Discharged
7	21/M	B	Stable	Grade V kidney	NOM + AE	Secondary HTN	16	Discharged
8	33/M	B	Stable	Grade IV liver	NOM + AE	HAP, ALF	9	Discharged
9	22/M	B	Stable	Grade IV liver	NOM + AE	None	8	Discharged
10	36/F	B	Stable	Pelvic Injury	AE + EF	Cardiac dysrhythmia	28	Discharged
11	29/F	B	Unstable	Pelvic injury	AE + EF	None	18	Discharged
12	28/M	B	Unstable	Grade IV liver	DCL + AE	Biloma	27	Discharged
13	34/M	B	Unstable	Grade IV liver	DCL + AE	Liver abscess	25	Discharged
14	30/M	B	Stable	Grade V spleen	NOM + AE	None	14	Discharged
15	35/M	B	Unstable	Grade IV liver	DCL + AE	Cardiac dysrhythmia, AKI, VAP, Sepsis, TIC	7	Mortality
16	30/M	B	Stable	Grade V spleen; Grade IV kidney	NOM + AE	None	15	Discharged

B = blunt; P = penetrating; NOM = nonoperative management; AE = angioembolization; EF = external fixation; DCL = damage control laparotomy; HTN = hypertension; HAP = hospital-acquired pneumonia; ALF = acute liver failure; AKI = acute kidney injury; VAP = ventilator-associated pneumonia; TIC = trauma-induced coagulopathy

Oral Papers IVA: Systems/Pediatrics/Burns Papers 96 - 101  
Paper 96: 2:00 PM – 2:10 PM  
**IN THE MIDST OF CHAOS: NAVIGATING PAEDIATRIC  
BURN AND CHEMICAL INJURY CARE IN ARMED  
CONFLICT ZONES**  
Kathryn Campos, MD  
Invited Moderator: Laura Haines, MD

**Introduction:** Paediatric burn injuries, including chemical burns, present a unique and dire challenge in armed conflict settings. The vulnerability of children to such injuries, compounded by the chaos of war, calls for urgent attention and specialized care. This systematic review aims to evaluate the current landscape of paediatric burn care, particularly chemical burn injuries, in these high-risk environments and propose strategic interventions.

**Methods:** We conducted a comprehensive systematic review of 1,545 records across databases including PubMed, Embase, and Cochrane Library. Our focus was on reports that specifically addressed paediatric burn injuries and paediatric chemical burns within the context of armed conflicts.

**Results:** Out of the initial 1,545 records, 23 were selected for inclusion. These reports detailed various aspects of paediatric burn care, ranging from initial management and surgical interventions to long-term rehabilitation. They highlighted the complexity of treating chemical burns in children, underscoring the need for specialized resources and training in conflict zones. Despite the efforts detailed in these reports, a significant gap remains in both practical care strategies and policy-level interventions for these vulnerable populations.

**Conclusion:** The review underscores the acute need for targeted initiatives and enhanced infrastructure to address paediatric burn injuries, especially chemical burns, in armed conflict settings. Prioritizing paediatric care in these scenarios is not just a medical necessity but a humanitarian imperative. Collaboration between medical professionals, humanitarian organizations, and policymakers is crucial to improve outcomes for these young victims of war.

#### Identification

1545 records identified through database searching

#### Screening

- 1545 records after duplicates removed
- 1545 records screened
- 1522 records excluded

#### Eligibility

- 23 full-text articles assessed for eligibility
- 0 full-text articles excluded

#### Included

23 studies included in qualitative synthesis (Paediatric Burn and Chemical Injuries)



## URGENCY TO BUILD PREHOSPITAL SYSTEMS IN INDIA TO IMPROVE MORTALITY

Divya Kewalramani, MD

Invited Moderator: Laura Haines, MD

**Introduction:** Chain of Survival (COS) emphasizes the importance of a trauma care framework in improving patient outcomes and reducing preventable deaths. Implementation in India has been hindered by inadequate infrastructure, limited resources, and the absence of a legal framework that guarantees access to timely care. To establish Right to Trauma Care (RTC) in India, it is essential to examine the current state of trauma care services and identify the gaps. This study aims to analyze data on trauma care delivery, focusing on the time taken to access medical treatment, availability of essential resources, and impact on patient outcomes.

**Methods:** A national stakeholder consultation convened government, medical, and civil society representatives in October 2023. Qualitative interviews were conducted to elucidate existing challenges in emergency medical services, encompassing pre-hospital care, ambulance services, and in-hospital treatment protocols. On-site audits of over 100 medical facilities and 50 ambulances across multiple states evaluated protocols, infrastructure, equipment, and human resources. Standardized checklists and assessment tools assessed trained staff availability, response times, guideline adherence, and patient outcomes. Thematic analysis identified common challenges; descriptive statistics summarized key audit findings.

**Results:** Audits found only 2% of medical facilities had adequate equipment, infrastructure, and manpower resources for providing trauma care. 91% of hospitals had ambulances which transported mostly deceased patients (98.5%), lacked equipment/oxygen (90%), and did not have trained personnel (95%). 30% of mortality was due to delayed emergency care. All hospitals lacked pre-hospital notification systems. There were no dedicated trauma surgeons and very few designated trauma centers. Orthopedic surgeons led trauma response in 50% of facilities without specific training in trauma care. 45% of registered deaths in 2020 (approximately 3.6 million) occurred without medical attention at time of death.

**Conclusion:** Audits and qualitative data demonstrated the lack of COS trauma care and high resulting mortality rate in India. These evidence-based insights seek to inform policymakers and healthcare authorities about the importance of establishing a statutory RTC framework in India. The RTC is not only a moral imperative but also a necessary step towards reducing the burden of traumatic injury in India.



## ENHANCING CIVIL-MILITARY SYNERGY IN SURGICAL CARE: STRENGTHENING LOCAL HEALTH SYSTEMS FOR ROBUST HUMANITARIAN RESPONSE IN ARMED CONFLICT AND DISASTER SETTINGS

Kathryn Campos, MD

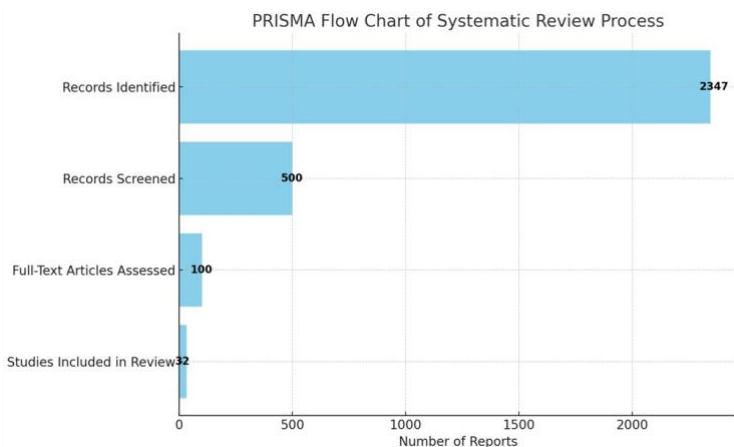
Invited Moderator: Laura Haines, MD

**Introduction:** The nexus between civil-military trauma care, surgical operations, and global health security in armed conflict and humanitarian disaster settings remains underexplored. This systemic review aims to bridge this gap by scrutinizing the interplay between these elements and their collective impact on the protection and medical treatment of civilians in conflict zones.

**Methods:** An extensive review of 2347 reports from databases including PubMed, Embase, and Google Scholar was undertaken. The criteria for inclusion focused on studies detailing civil-military emergency medical team operations, humanitarian surgical strengthening, and their role in enhancing global health security in austere environments.

**Results:** Of the initial pool, 32 reports met the inclusion criteria. They covered topics ranging from civil-military cooperation logistics in medical emergencies to enhancing surgical capacity in dire situations. A key theme emerged: the vital role of local healthcare workforce, HMOs, NGOs, and Civil-Military actors in developing and executing health security programs. This local involvement ensures contextual relevance and sustainability, thus improving surgical care effectiveness in conflict and disaster settings.

**Conclusion:** The review highlights a critical literature gap in integrating civil-military trauma care with humanitarian surgical strengthening and global health security. Emphasizing the need for locally informed health security programming, it calls for empowering civil-military, local healthcare workforce, HMO, and NGO coordination. This collaboration is essential for delivering effective surgical care and enhancing global health security in areas affected by armed conflict and humanitarian crises. The focus on local involvement and sustainable practices is key to long-term health system resilience in austere environments.



**CONFRONTING THE CRISIS: ADVANCING BURN INJURY  
TREATMENT IN AUSTERE ENVIRONMENTS AMIDST  
GLOBAL CHALLENGES**

Kathryn Campos, MD

Invited Moderator: Laura Haines, MD

**Introduction:** Burn injuries are a significant concern in austere environments, where access to specialized surgical care is often limited. This challenge is intensified by the destabilizing effects of armed conflicts and humanitarian crises on healthcare systems. Although recent initiatives have made strides in improving access to burn care, promoting injury prevention, and driving global advocacy, there is still a critical need for comprehensive research and sustainable solutions in burn care within these challenging settings.

**Methods:** Our systematic review encompassed several databases, including PubMed, Embase, and Google Scholar, to identify relevant literature on strategies for improving burn surgery in austere environments.

**Results:** Out of 1,232 identified records, 16 were deemed pertinent for review. These reports highlighted initiatives to improve access to burn surgical care and training in austere environments. They covered general aspects of civilian burn care access and injury types, along with interventions to strengthen burn surgical services. However, there was a notable lack of detailed quantitative and qualitative evaluations of burn surgery training and care implementation by local and humanitarian clinicians in these settings.

**Conclusion:** There is a paucity of comprehensive literature on initiatives to enhance burn surgical care and training programs in austere environments. Developing and prioritizing such initiatives, particularly in training for humanitarian surgical services, is essential to improve civilian health outcomes in humanitarian contexts.

**AUTOLOGOUS CELL HARVESTING DEVICE AND  
COPOLYMER-BASED EPIDERMAL SKIN SUBSTITUTES  
FOR THE MANAGEMENT OF PARTIAL-THICKNESS  
FACIAL BURNS**

Alfredo Cordova, MD

Invited Moderator: Laura Haines, MD

**Introduction:** Facial burns may be devastating and disfiguring injuries leading to significant identity, social, psychological, and emotional issues. Hypertrophic scarring and dyspigmentation are common with operative and nonoperative management. Autologous split-thickness skin grafts may be indicated in some instances. The autologous "spray-on skin" (ASOS) has achieved definitive closure of burn injuries by enabling autologous skin cell suspension (ASCS) to be applied as an epidermal autograft achieving good scarring outcomes in addition to effective healing. Copolymer-based epidermal skin substitutes have been described to be used in combination with ASOS to cover treated dermal wounds. Combining both methodologies may allow for improved wound healing, earlier re-epithelialization, and lead to better aesthetic and functional outcomes for partial-thickness facial burns.

**Methods:** Eight patients with superficial and deep partial-thickness facial skin burns underwent tangential excision using the "hydro-scalpel". A partial thickness donor sample was harvested at 0.008 inch and ASCS was prepared through enzymatic and mechanical disaggregation utilizing ASOS. After early tangential excision, ASCS was evenly sprayed on the prepared bed wound on the face, and these areas were covered with Polylactic acid epidermal skin substitute. Dressings were removed by POD#7.

**Results:** Complete wound closure and early epithelialization and pigmentation was observed upon takedown of the dressings. No evidence of hypertrophic scarring, enhanced pigmentation or infection was observed upon 10, 30, and 60 days of follow-up. The patients experienced no complications and were pleased with the final outcome.

**Conclusion:** We demonstrate the efficacy of precise dermal excision followed by application of ASCS and copolymer-based epidermal skin substitute as a safe modality for the treatment of partial-thickness facial burns with improved functional and aesthetic outcomes.

## DISPARITIES IN EMERGENCY NEUROSURGICAL ACCESS FOR TRAUMATIC BRAIN INJURY CARE IN THAILAND A GEOSPATIAL PERSPECTIVE

Arnav Mahajan, MD

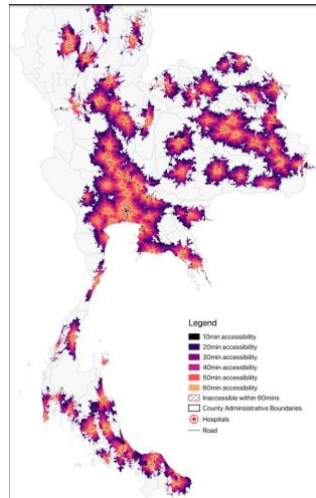
Invited Moderator: Laura Haines, MD

**Introduction:** The incidence of traumatic brain injury (TBI) in Thailand is high. This poses critical health system challenges as Thailand does not have dedicated trauma centers, forcing the referral of TBI cases to hospitals equipped with neurosurgical facilities for advanced treatment. The escalating incidence of TBI, coupled with a diminishing neurosurgical workforce, necessitates a critical evaluation of the nation's capacity to provide emergency neurosurgical trauma care.

**Methods:** We utilized geospatial mapping through QGIS and R to analyze the accessibility to definitive neurosurgical care for TBI patients. To model national TBI prevalence, we applied probabilistic sampling to a geospatial record of road traffic accidents in 2022. We stratified our results as national accessibility to emergency neurosurgical care, national accessibility for TBI care, and regional accessibility for TBI care. Accessibility metrics were reported as population and distance-to-care metrics.

**Results:** Out of 95 hospitals with neurosurgical capacity, 9 lacked full-time neurosurgical staffing. Using Dijkstra's algorithm, we identified that 44% of the population lacked access to any emergency neurosurgical center within an hour of care [Figure 1]. Probabilistic sampling estimated 94,096 potential TBI patients. Nationally, TBI patients would not be able to receive timely care in 24% of the cases. For the health service regions of Thailand, only 4/13 health regions had hospitals staffed with at least one neurosurgeon. For the three urban regions, the mean TBI patient travel distance was 6.2km (13 minutes). The sole rural hospital's mean distance was 96.8km (77 minutes).

**Discussion:** Our study illuminates a critical gap in Thailand's readiness to provide timely trauma care for TBI patients. The national disparity in access reflects urgent need to increase efforts for neurosurgical training, upskilling of general surgeons, and optimizing extant surgeon distribution to rural regions. The disparities between urban and rural care reflect a stark inequality that could have significant ramifications for patient outcomes. The data suggests that realignment towards regionalized trauma center networks for the 11 health regions that do not have neurosurgical care capacity could improve access to care.



**APPLYING THE FIVE PILLAR APPROACH TO REDUCE  
MOTORCYCLE DELIVERY DRIVER [MDD] INJURIES:  
THE QATAR EXPERIENCE**

Rafael Consunji, MD

Invited Moderator: Thomas Duncan, DO

**Background:** During the COVID-19 lockdown period in Qatar, there was a marked increase in the dependence on motorcycle deliveries of food and groceries. This led to a significant increase in the number of registered motorcycles and injuries and deaths from injuries to MDDs. A multi-sectoral response to increase safety for MDDs was implemented, based on the Five-Pillar Approach recommended by the Global Plan for the Decade of Action for Road Safety [DoARS].

**Objective:** To describe the multi-sectoral response, to reduce injuries MDDs, based on the Five-Pillar Approach recommended for DoARS.

**Programme Description:** The problem was clearly identified and defined, it was brought to the attention of the National Traffic Safety Committee and the Traffic Directorate and a stakeholder meeting was convened. A plan to increase enforcement of licensing requirements for MDDs, implement high-visibility motorcycle designs requirements, safety training for all MDDs and increase public awareness was created and implemented.

**Outcome and Learnings:** Monitoring of MDD injuries through the Qatar National Trauma Registry showed a 20% reduction in moderate to severe MDD injuries despite a 320% increase in registered motorcycles.

**Implications:** A multi-sectoral motorcycle safety program, based on the recommended Five-Pillar Approach, can significantly reduce injuries to MDDs.

**Conclusion:** MDD injuries can be reduced through the identification of this high-risk and emerging injury risk area and the implementation of timely multi-sectoral injury prevention campaigns.

# ACCESSIBILITY AND READABILITY OF ONLINE PATIENT EDUCATION MATERIALS ON FIREARM SAFETY: A CROSS SECTIONAL ANALYSIS OF HOSPITAL AND NATIONAL INJURY PREVENTION LITERATURE

Nicholas Beattie, MD

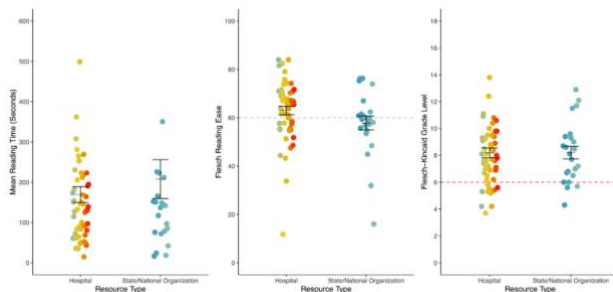
Invited Moderator: Thomas Duncan, DO

**Introduction:** Gun violence is a preventable public health crisis with rising epidemiologic trends. However, healthcare providers rarely disseminate firearm injury prevention resources. Therefore, patients may seek out online injury prevention resources (OIPRs), whose effectiveness as educational tools depends on their readability. Our investigation seeks to understand the practical utility and readability of firearm injury OIPRs provided by hospitals and national organizations.

**Methods:** We analyzed firearm injury OIPRs from two primary resources: trauma centers (TC) accredited by the American College of Surgeons, and national health organizations. We examined resources directed towards child safety. We assessed readability metrics using reading time, Flesch-Kincaid reading level, Flesch reading ease, and text compositional structure through korPus package on R. We excluded multimedia, and mixed-methods resources requiring an in-person component.

**Results:** 105 trauma centers offered firearm injury OIPRs. Level 1 TCs were more likely to provide resources for both adults (18% availability) and pediatrics (49% availability) compared to Level 2 (7%, adults; 18%, pediatrics) and Level 3 TCs (16%, adults). After removing duplicates, we included 53 hospital OIPRs and 23 national OIPRs. Notably, 11 TC OIPRs lacked pediatric injury prevention information, whereas all national OIPRs addressed this critical area. Average reading time of hospital resources was 169s (vs. 208s in national resources,  $p=0.47$ ). Assessment of Flesch-Kincaid revealed resources from both groups were above the average recommended health literature 6th grade reading level (8.2 vs 8.2,  $p=0.96$ ). Flesch reading ease demonstrated resources were fairly difficult to read between both OIPRs (63 v 58,  $p=0.13$ ) [Figure 1].

**Conclusion:** The majority of current OIPRs on firearm injury fail to comply with recommended readability standards. Given the lack of healthcare provider counseling, this could exacerbate existing disparities in groups with lower health literacy and access to healthcare services. There is insufficient pediatric firearm safety education in 21% of hospital OIPRs, despite it being a leading cause of pediatric death in the United States. Future research should identify the role of commercial firearm safety information and standardize the readability of firearm safety education materials. It should also ensure accessibility to disproportionately impacted populations.



**CHARACTERIZING AND COMPARING BICYCLE INJURY TRENDS: STANDARD, MOUNTAIN, AND ELECTRIC BIKES IN THE UNITED STATES (2013-2022)**

Ryan Frier, MD

Invited Moderator: Thomas Duncan, DO

**Objective:** The purpose of this study is to characterize and compare trends in injuries resulting from standard, mountain, and electric bicycles among adults in the United States.

**Methods:** Data were analyzed from the National Electronic Injury Surveillance System (NEISS) regarding standard, mountain, and electric bicycle injuries treated in U.S. emergency departments from 2013 - 2022. Sample weights were applied to determine trends in yearly incidence, patient demographics, and injury patterns.

**Results:** There were an estimated 2,814,236 bicycle injuries from 2013 - 2022 (standard: 2,655,278, mountain: 96,022, electric: 62,937). While standard bicycle injuries comprise the majority of total bicycle injuries, the proportions of mountain and electric bike injuries have increased over time (Table 1, Fig 1). Patients with mountain and electric bike injuries tend to be older (Fig 2). Mountain bike injuries more commonly involve upper extremities, particularly fractures and dislocations (Fig 3, 4). Electric bike injuries are more likely to involve the face and lower extremities (Fig 3), be associated with alcohol and drug use, and result in hospitalization (Table 3).

**Conclusions:** Injury patterns are significantly different between standard, mountain, and electric bikes. The rapid increase in the incidence of electric bikes may be a cause for concern, given an older patient age distribution, a greater association with alcohol and drug use, and a greater risk of hospitalization. The significant increase in upper extremity injuries among mountain bicyclists may indicate a greater need for specialized protective equipment such as elbow guards and body armor.



# LOCALIZING GLOBAL ROAD SAFETY FRAMEWORKS: EFFICACY OF THE ZERO FATALITY CORRIDOR MODEL IN REDUCING ROAD CRASH MORTALITY IN INDIA

Divya Kewalramani, MD

Invited Moderator: Thomas Duncan, DO

**Introduction:** Road safety in India faces critical challenges, including a shortage of ambulances, illegal parking, infrastructure issues, and a culture of lane indiscipline, exacerbating the risk of road crash fatalities (RCF). In 2017, SLF, in collaboration with the State of Maharashtra, India, introduced the ZFC model, an adaptation of the safe system approach focusing on road engineering, police enforcement, rapid emergency care, and community engagement. We hypothesized ZFC implementation (ZFC-I) would reduce mortality on high-risk highways in India, potentially serving as a replicable model for improving road safety.

**Methods:** In 2017, ZFC was first implemented on the deadliest highway in India, the Mumbai-Pune Expressway (MPEW). From 2010-2015, MPEW witnessed 1,758 accidents, resulting in 690 deaths and 1,655 serious injuries. By combining forensic crash investigation (application of Haddon's Matrix), crash reconstruction (PC-Crash 14), and scientific Crash Vulnerability Audits (CVA), the development of the ZFC model was rooted in a data-driven, evidence-based approach. This included resolving over 3,800 engineering defects, strengthening traffic law enforcement, enhancing emergency response capabilities with a network of ambulances and trained paramedics, and raising road safety awareness among road users and local communities. Fatality data was compared before and after the first 2017 ZFC-I from 2016 to 2023.

**Results:** Compared to 151 fatalities in 2016, implementation of ZFC on MPEW led to a significant reduction in RCF: 30% in 2017 ( $p=0.01$ ), 43% in 2019 ( $p=0.02$ ), 41% in 2021 ( $p=0.001$ ) and 58 % in 2023 ( $p=0.001$ ). Ambulance response times were reduced from 55 to 20 minutes ( $p=0.001$ ) and patient handover times from 268 to 160 minutes ( $p=0.01$ ), while increasing ambulance fleet utilization by 270% ( $p=0.001$ ).

**Conclusion:** ZFC-I on MPEW resulted in sustained mortality reduction. This has resulted in work by the Government of India and SLF to replicate the model on 100 other high-risk highways.

Mumbai-Pune Expressway Fatalities Data								
Project Stretch	2016	2017	2018	2019	2020	2021	2022	2023
Number of Fatalities	151	105	110	86	66	89	91	63
Percentage Change (Since 2016)	0	30.46 ↓	27.15 ↓	43.05 ↓	56.29 ↓	41.06 ↓	39.74 ↓	58.28 ↓

**PEDESTRIAN SAFETY IN QATAR AFTER A DECADE OF  
ACTION FOR ROAD SAFETY: ANALYZING NATIONAL  
STATISTICS AND NATIONAL TRAUMA REGISTRY DATA**

Rafael Consunji, MD

Invited Moderator: Thomas Duncan, DO

**Introduction:** Road traffic injuries [RTIs] are the leading cause of preventable mortality in Qatar. In 2011, the country opted to participate in the Decade of Action for Global Road Safety [DoARS], with the goal to reduce the number of road traffic deaths and injuries by 50% by 2020. The objective of this study is to analyze indicators of road safety in Qatar, from 2011-2020, by combining national statistics and trauma registry data to report the status of road safety in Qatar and make recommendations to further improve road safety

**Methods:** Data on all patients with moderate to severe road traffic injuries seeking hospitalization and/or care from 2011-2020, were collected from the trauma registry of the national Level 1 trauma referral center. Monthly and annual aggregate data on road traffic deaths, injuries and motor vehicle crashes, from the publicly accessible website of the Ministry of Development, Planning and Statistics were likewise collected.

**Results:** The RTI death rate [per 100,000 population] was reduced by 61% and the RTI rate reduced by 38%, from 2011 to 2020. The pre-hospital RTI death rate dropped by 60% while the in-hospital RTI death rate was reduced by 65%. It is estimated that 858 potential road deaths were prevented during the DoARS in Qatar.

**Conclusion:** The participation in the Decade of Action for Global Road Safety, by complying with the UN-recommended 5-pillars approach, by Qatar has resulted in reductions in road deaths and injuries that exceed the goals set by DoARS.

**IMPACT OF THE COVID-19 STAY AT HOME ORDER AND  
HOUSEHOLD INCOME ON PENETRATING TRAUMATIC  
INJURY RATES**

Lindsey Braden, MD

Invited Moderator: Thomas Duncan, DO

**Introduction:** Unprecedented public health safety measures instituted in the state of California to reduce the spread of COVID-19, such as the mandatory statewide stay-at-home (SAH) order issued on March 19, 2020, led to significant social and economic disruptions in daily life. We conducted a retrospective analysis comparing assaults, penetrating injuries sustained, and related mortalities before and during the pandemic, and further explored the average income of the area of injury to determine if socioeconomic status was a determinant of violent crime incident rates.

**Methods:** This retrospective cross-sectional study utilized Kern Medical's trauma registry to identify patients in Kern County who presented to the emergency department with a gunshot wound (GSW), stab wound, or assault between March 2019 and February 2021. Each case was categorized as pre-COVID or COVID and further subclassified as lower income and higher income based on California census data.

**Results:** Our study found 803 patients met inclusion criteria. The overall incidence of stab wounds relatively decreased during COVID ( $p=0.0027$ ) while the incidence of GSWs relatively increased ( $p=0.0041$ ) (Table 2). Furthermore, higher-income areas had a relatively more significant increase of GSWs during COVID ( $p=0.0004$ ) and concomitantly stab wounds significantly decreased ( $p=0.0201$ ) (Table 3). Both lower and higher income areas, and especially the higher income areas, experienced a seemingly higher increase in mortality (Table 3).

**Conclusion:** The geographical distribution of trauma suggests that trauma prevention education should be delivered to the entirety of Kern County with emphasis directed toward aggressive crimes during times of heightened stress such as the Stay At Home Order.

## CHARACTERISTICS OF TRAIN-RELATED INJURIES IN JAPAN: ASSOCIATIONS WITH SUICIDE

Kenta Shida, MD

Invited Moderator: Thomas Duncan, DO

**Background:** In Japan, the overall suicide rate is notably high, ranking as the seventh leading cause of death. Given the prevalence of train usage as a common method of transportation, it can be assumed that train-related injuries (TRI) often result from suicide. This study aims to elucidate the characteristics of TRI, including age distribution, injury sites and severity, and the association between these characteristics and suicide in Japan.

**Methods:** During the study period, cases of train-related traumas transported to hospitals across Japan were extracted from the Japan Trauma Data Bank (2019-2022). Analyses encompassed age, gender, cause of TRI, anatomical sites, severity of injuries, and invasive interventions.

**Results:** Among registered cases, a total of 462 patients were enrolled. The mean age was 43, with the 20s age group comprising the highest proportion (24.8%) (Figure 1). 61% were male, and the median Injury Severity Score was 25. The most common cause of TRI cases was suicide (55.6%), followed by accidents (34.5%), unknown causes (8.8%), and cases with missing data (1.1%). In this study, it was observed that suicides outnumbered accidents among individuals aged below 20, whereas accidents were more prevalent among individuals aged 70 and above (Figure 2). The mortality rate was 48.1%. Notable injuries, defined as AIS greater than or equal to 3, included head (52.4%), chest (49.9%), abdomen (9.0%), and pelvis/lower limbs (41.6%). When compared to cases with other causes, individuals in the suicide group were significantly more common at younger ages, predominantly females, had higher injury severity scores, and experienced severe head and chest injuries. However, no significant difference was observed between the suicide and other cause groups regarding mortality rates.

**Conclusion:** The cause of TRI in Japan predominantly stems from suicide. The clinical patterns observed in TRI exhibit some unique features. These findings may pave the way for future advancements in trauma care and potentially the prevention of TRI.

Fig 1. The Incidence Rate of TRI by Age Group

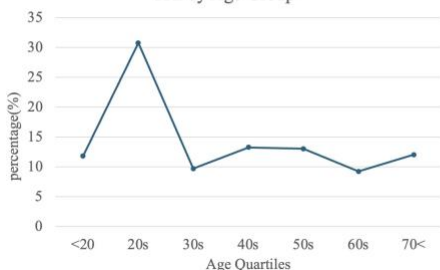
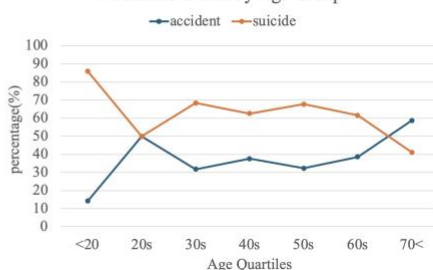


Fig 2. The Proportion of Suicides and Accidents in TRI by Age Group



**CHANGING PATTERNS OF TRAUMA ADMISSIONS  
FOLLOWING SELF-HARM AND SUICIDE ATTEMPTS: A  
FIVE-YEAR ANALYSIS IN A KOREAN REGIONAL  
TRAUMA CENTER**

Byungchul Yu, MD

Invited Moderator: Thomas Duncan, DO

**Background:** The prevalence of self-harm and suicide is increasing in Korea. This study aims to investigate the changes in the prevalence of trauma admissions following self-harm and attempted suicide in a Korean Regional Trauma Center.

**Methods:** We analyzed data on admissions to Incheon Regional Trauma Center from 2017 through 2022. Patients were grouped by age (18, 18-65, >65 years), and demographics, mechanism of injury, injury severity, and mortality were analyzed across age groups.

**Results:** A total of 704 cases were included in this study: 47 (6.7%) patients were under 18 years old, 531 (75.4%) were aged 18-65 years, and 63 (8.9%) were over 65 years old. Over the years, the prevalence increased in the age groups of 18 and >65. The majority of cases involved stab injuries (333, 47.3%), followed by falls from height (216, 30.7%). In the 18 and >65 age groups, falls from height were the most common mechanism of injury. The overall mortality rate was 14.9%: 17% in the 18 age group, 11.5% in the 18-65 age group, and 25% in the >65 age group, respectively.

**Conclusion:** The findings of this study underscore the escalating prevalence of trauma admissions following self-harm and attempted suicide, particularly among the younger and older age groups, in Korea.

**COULD SEVERE SANCTIONS PREVENT DRUNK-  
DRIVING INJURIES? A RETROSPECTIVE NATION-WIDE  
COHORT STUDY FROM THE NATIONAL HEALTH  
INSURANCE RESEARCH DATABASE**

Ling-wei Kuo, MD

Invited Moderator: Thomas Duncan, DO

**Background:** Driving under the influence (DUI) contributes to a significant portion of traffic accidents in Taiwan. Among these crashes, alcohol-related incidents predominate in Taiwan. From 2008 to 2013, the administrative and legislative departments collaborated to adjust the amount of fines and the length of jail time penalty for drunk driving. The goal of this study is to analyze if the sanction change affected the incidence of drunk-driving and the subsequent hospital admission.

**Methods:** We retrospectively analyzed the data from the National Health Insurance Research Database (NHIRD) from 2004 to 2019. In this interval, three penalty changes were made in January 2008, December 2011, and June 2013. We employed interrupted time-series analysis (ITSA) method to examine the effect of different policy interventions on the number of drunk-driving injuries and deaths, and the related hospital admission outcomes.

**Results:** From January 2004 to January 2008, the number of drunk-driving injuries and deaths gradually increased over time. After the first penalty adjustment, the incidence showed an abrupt drop, but the time trend seemed similar to the first period with a gradual increase in numbers at the interval between January 2008 and December 2011. At the second law penalty adjustment, the incidence also demonstrated an immediate drop, and the slope showed a gradual decrease in the period of December 2011 to June 2013. At the third penalty adjustment, the incidence of drunk-driving injuries had another drop, but the trend of the last segment showed a stable incidence of drunk-driving numbers, with no obvious positive or negative effect.

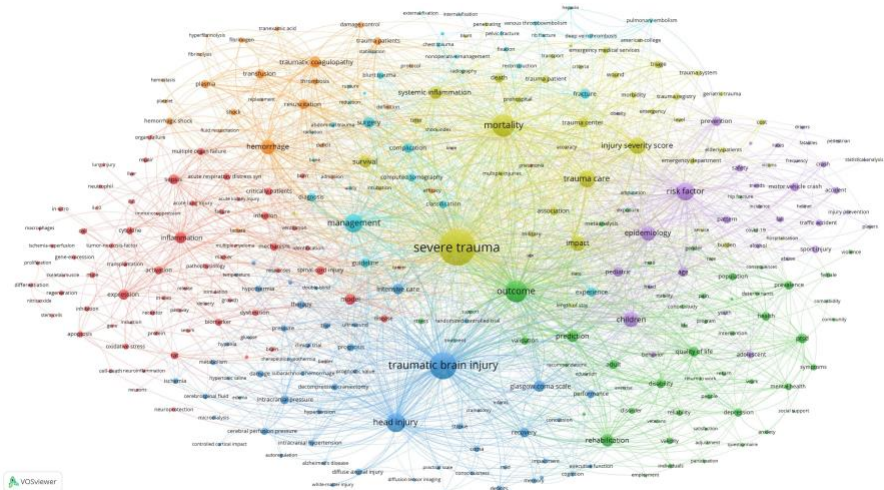
**Conclusions:** Increasing the fine and maximum jail sentence of DUI offenders seems to have an immediate effect on drunk-driving incidence, but the long-term effect of the policy change might have different outcomes after each adjustment. A plateau effect that blocks the deterrence of the maximum penalty might exist. Further long-term analysis should be conducted to examine the influence of the policy change.

# **BIBLIOMETRIC AND VISUAL ANALYSIS OF SEVERE TRAUMA LITERATURE IN THE PAST 20 YEARS**

Rui Li, MD

Invited Moderator: Thomas Duncan, DO

Severe trauma is a fundamental discipline in medicine, with profound implications for patient care and outcomes. Over the past 20 years, the domain of severe trauma research has witnessed substantial evolution, marked by a surge in research activity and associated literature publications. This study embarks on an examination of the publication status within the severe trauma domain, aiming to elucidate prevailing research trends and identify areas warranting further development to guide future insights. We retrieved a total of 16,939 relevant publications in the severe trauma field over the past 20 years and conducted bibliometric analysis. Results indicate a steady growth in annual publications on severe trauma research, with the United States leading in both publication volume and citation frequency. We summarized productive countries/regions and research institutions and depicted a collaborative network among researchers and institutions, showcasing extensive cooperation across different countries and institutions. Significant progress has been made in severe trauma research in clinical diagnosis, treatment, epidemiology, prevention, and pathogenesis. However, despite advancements, the utilization of cutting-edge interdisciplinary methods in trauma-related research remains lagging. In conclusion, this study provides a comprehensive depiction of the current status of the severe trauma field and proposes opportunities and innovative directions for future development.



Oral Papers V: Quality Improvement Papers 112 - 121  
Paper 112: 3:10 PM - 3:20 PM  
**GETTING WITH THE GUIDELINES: GERIATRIC  
TRAUMA ACTIVATION**  
Randeep Jawa, MD  
Invited Moderator: Marcelo Riberio, PhD

**Introduction:** The ACS Committee on Trauma recently revised geriatric trauma activation criteria. Accordingly at our facility, the partial or full trauma team is activated for geriatric patients with SBP 110, HR >120, fall on anticoagulant/antiplatelets, any long bone fracture, or GCS13. We evaluated the effects of the revised criteria.

**Methods:** A retrospective review of the trauma registry at a level 1 trauma center for all patients age  $\geq 65$  years presenting to the ED who were hospitalized with blunt traumatic injury during the 11 months before (2022) and after (2023) institution of the revised trauma team activation criteria.

**Results:** Hospitalizations following trauma team activation meeting registry inclusion criteria.

	2023	2022	p-value
Partial and full trauma team activation (n)	382	158	-
Fall as mechanism of injury	83.0%	76.6%	0.06
Anticoagulant/antiplatelet use	66.0%	41.8%	0.001
Injury Severity Score (median, IQR)	9 (5,14)	11 (7, 19)	0.001
Head/Neck AIS $\geq 3$ (%)	28.3%	34.8%	0.94
Hospital length of stay (days, median, IQR)	7 (5,11)	10 (5, 15)	0.001
ED disposition: ICU	44.8%	51.9%	0.17
Complications	29.8%	23.4%	0.22
In-hospital mortality	5.8%	10.1%	0.06

**Conclusions:** Trauma team activation reduced ( $p > 0.001$ ) the time to index CT vs non-activations (2023: 46 min (IQR 39,57) vs 185 min (130, 251) and 2022: 48 min (IQR 42,63) vs 217 (145,302)). Post guideline implementation patients were more often on anticoagulants/antiplatelets, but were less severely injured, with shorter hospital length of stay. The volume of trauma activations that were admitted increased by 2.4-fold following the revised guidelines in 2023. Further the volume of trauma activations with injury meeting registry criteria not requiring hospitalization increased from 20 to 139. Finally the volume of trauma team activations that did not meet criteria for inclusion in the trauma registry increased over 9-fold from 87 to 821. Given the intensive resources required for trauma activation in less severely injured patients, further study is indicated for optimal activation criteria.



WITHDRAWN

**COST-EFFECTIVENESS OF WHOLE-BODY COMPUTED  
TOMOGRAPHY (PAN-SCAN) FOR DIAGNOSTIC OF  
MULTIPLE TRAUMA PATIENTS IN PHRAPOKKLAO  
CHANTHABURI HOSPITAL**

Tanapon Supapon, MD

Invited Moderator: Marcelo Riberio, PhD

**Background:** Patients with multiple injuries are challenged to evaluate and to exclude a potentially lethal condition. Rapid diagnosis is important to appropriately treat patients. Objectives: The purpose of this study was to compare classical imaging to whole-body computed tomography (pan-scan) in the initial evaluation of multiple trauma patients.

**Material and Methods:** This was a retrospective review of all multiple or high-risk trauma patients who received pan-scan during the initial evaluation at an urban trauma center from July 1, 2022 to January 31, 2024. Results: Between August 1, 2020 to January 31, 2021 and August 1, 2023 to January 31, 2024 patients were assessed for eligibility. Most, 618/927 (66.7%) received classical imaging and 474/1532 (30.9%) received pan-scan. There were no differences between cohorts in demographic data, hemodynamic status, Glasgow Coma Scale and mechanism of injury in emergency department. Missed or delayed diagnosis after pan-scan is zero per cent but thirty per cent in classical CT. Mortality rates were reducing for pan-scan and classical CT (2.1% vs 6.9%). Pan-scan may be preferable to classical CT during the initial assessment for possible multiple and high risk trauma patients because of a single contrast injection for whole body CT.

**Conclusion:** Around thirty percent of patients with multiple trauma had concomitant or silent injuries. For hemodynamically stable patients CT scanning identified those who require surgical intervention and those who may be managed non-operatively, therefore liberal CT-scanning is advisable for this patient group. Diagnosing patients with an immediate pan-scan does not reduce in-hospital mortality compared with the standard radiological work-up. Because of the increased radiation dose, future research should focus on the selection of patients who will benefit from immediate pan-scan.

**Keywords:** Multiple trauma, Whole body, Computed tomography scan. \*  
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**DISLODGE MENT RATE OF PERCUTANEOUS  
ENDOSCOPIC GASTROSTOMY (PEG) TUBES IN TRAUMA  
PATIENTS AT A LEVEL 1 TRAUMA CENTER**

William Tyler Crawley, MD

Invited Moderator: Marcelo Riberio, PhD

**Introduction:** PEG tubes are a commonly performed procedure in patients who require long-term, secured, enteral access. The procedure has grown in popularity due to its ease of placement, which can be performed at the bedside under conscious sedation. If the tube is removed in the first 4 weeks following placement, there is the risk of an uncontained gastrotomy as the stomach has not had time to adhere to the abdominal wall. Many of these incidents can be salvaged with the placement of a catheter through the site. These patients often then require replacement of the tube by IR, or, in more severe situations, exploration in the OR. Currently, there is no standard of care or best practice for how to appropriately secure these tubes.

**Methods:** This retrospective cohort study included adult trauma patients admitted to a level 1 trauma center between July 2018 – June 2023 who required PEG tube placement. Data was obtained from the hospital's trauma registry. All PEG placements were performed under the supervision of the core trauma faculty which included 7 critical care trained surgeons. PEGs were placed using a "pull" technique which was similar between all of the faculty. PEGs were secured using the rubber bumper provided in the kit.

**Results:** The charts of 184 patients admitted to the trauma ICU from July 2018 – June 2023 were reviewed. 16 patients were excluded due to insufficient data and 74 were excluded due to gastrotomy tube placement either surgically or by IR. This left 94 patients in our final analysis, of which, there was a 15% overall rate of early dislodgement, defined as removal less than 4 weeks following placement. For those with a dislodgement, 71% required IR intervention and 36% required exploration in the OR.

**Conclusions:** This single-center retrospective study highlights the high complication rate associated with PEG tube placement and the potential morbidity with early dislodgement. While techniques for PEG tube placement and methods for securing tubes are variable, our study documents the need for additional research and best practices in order to enhance the safety of this procedure

**EFFECTS OF CONSECUTIVE OVERNIGHT ON-CALL  
SHIFTS ON TRAUMA SURGEONS' WELL-BEING: A  
PSYCHOLOGICAL AND PHYSIOLOGICAL ANALYSIS**

Susan Hallbeck, Sergio Navarro, MD

Invited Moderator: Marcelo Riberio, PhD

**Introduction:** Surgeons are reporting burnout, which may be exacerbated by on-call/night shifts. Several studies have focused on surgeon burnout, but few simultaneously examined psychological and physiological metrics associated with burnout.

**Methods:** Eight attending trauma surgeons at a Level 1 Trauma Center were observed over three periods, consisting of nine consecutive days: three days before night shifts, three consecutive night shifts, and three days after night shifts. Participants completed Daily Wellness Surveys (DWS) evaluating stress and fatigue levels and wore a Fitbit Sense 2 (Fitbit Inc., CA, USA) to continuously track surgeons' heart rates (HR). Stress and fatigue levels were reported on a 7-point Likert Scale from 1 to 7 (1=lowest level of stress and fatigue to 7=highest). HRs were averaged over 30-minute intervals. Participants' baseline HRs were defined as participants' minimum recorded HR during the nine days. Changes in surgeons' HRs were calculated using percent differences between average HRs and baseline HR. ANOVA and post-hoc Student's t-tests were utilized to evaluate differences by period. Stress, fatigue, and HR were reported using medians (IQR).

**Results:** Five women and three men were enrolled for a collective sum of 72 days. HR data were collected during 60 days, and 64 DWS were completed. Night shifts had significantly greater levels ( $p=0.0010$ ) of current stress (4, 4-5) than the three days before (3, 2.5-5) or the three days after (3, 2-4.25). The three days post-night shifts had significantly lower fatigue levels ( $p=0.0006$ ) since waking (5, 4-6) relative to night shifts (6, 4.5-6) and the three days prior (5, 4-6). ANOVA revealed significant differences ( $p\text{-value}=0.0001$ ) in the percentage increase of surgeons' HR relative to baseline when comparing before (58.27%, 40.21%-76.82%), during (58.33%, 40.98%-76.01%), and after night shifts (56.35%, 39.76%-76.25%).

**Conclusion:** This pilot study shows the impact of consecutive night shifts on stress and fatigue levels. Subjective stress and fatigue levels revealed night shifts were the most stressful while fatigue levels were minimized during off days. Changes in HR may be attributable to changes in activity, stress, fatigue, or physiological factors like dehydration. Additional work will explore the effects/correlations of these factors on HR and stress/fatigue levels.

**DOES THE AVAILABILITY OF NON-CROSS  
MATCHED BLOOD IN THE TRAUMA BAY EFFECT  
THE CARE OF TRAUMA PATIENTS? A  
RETROSPECTIVE STUDY FROM A LEVEL-II  
TRAUMA CENTER**

Adam Lee Goldstein, MD

Invited Moderator: Marcelo Riberio, PhD

**Introduction:** The standard of care for resuscitation of the hypotensive trauma victim requires timely administration of blood products. An integral part of the local trauma system is a precise and rapid utilization of blood products for transfusion. Unmatched type-O red blood cells (UORBC) are available in the emergency room (ER) of many trauma centers, with an increasing transition to whole blood. Despite the evidence recommending the use of blood products, many centers around the world do not have the ability to store and provide blood products in the ER. Here we examine the effect of available UORBC in the ER on the hospitalization and outcome of trauma patients. Method: A retrospective study at a level two trauma center comparing patients in the trauma bay the year before and the year after blood was stored in the ER. Results: A total of 116 patients arrived in the trauma bay over two years. Seventy four in the year before blood was stored in the ER, and 142 the year after. Within the cohort, there was a trend towards more emergency surgery in the year before (0.09), and significantly more total blood products given in the ER the year after (0.04). Subanalysis of only the patients receiving blood in the trauma bay showed in yr2 significantly more UORBC given in the trauma bay (0.05), MORE patients receiving UORBC (p 0.03), and more patients given blood while still in the ER (0.001). Between the two groups, also in the subanalysis, there was no significant difference in intensive care unit length of stay, mortality, or discharge disposition.

**Conclusion:** The availability of UORBC in the ER had no effect on patient outcome or hospital length of stay. Once blood was available in the ER, there was significantly more blood products given in the ER, and a trend towards less emergency surgeries.

**QUALITY IMPROVEMENT IN TRAUMA TRANSFERS  
FROM AN EMERGENCY DEPARTMENT WITHOUT  
LEVEL-ONE TRAUMA CAPABILITIES**

Brain Goldberg, MD

Invited Moderator: Marcelo Riberio, PhD

**Introduction:** This ongoing quality improvement project investigates the dynamics and implications of trauma transfers from the emergency department at a non-trauma center academic medical center to Level 1 Trauma Centers, focusing on enhancing patient outcomes and ensuring quality assurance. The study aims to comprehensively collect and review trauma transfer data, shedding light on patterns, indications, and clinical considerations influencing the trauma transfer process. By analyzing the process from the initial evaluation to ambulance transfer to trauma centers, this project seeks opportunities for improvement in patient care.

**Methods:** Beginning in July 2023, an electronic medical records report was run each month to identify patients transferred from the initial emergency department to a different receiving hospital in the previous month. A retrospective chart review was conducted of patient's who were transferred due to trauma. Their age, sex, chief complaint, mode of arrival, total time in the emergency department, receiving hospital, and what modality of imaging, if any, the patient received was examined.

**Results:** During the period July 2023 through December 2023, 40 patients were transferred to four different hospitals. The receiving hospital with the most transfers (n=37) was 0.6 miles away from the originating emergency department. Thirty-seven of the 40 patients had documented mechanisms of injury as either penetrating or blunt force trauma. The two most common chief complaints were gunshot wounds (n=9) and motor vehicle collisions (n=9). Twenty-five patients underwent some form of imaging in the emergency department at the initial hospital. Fifteen of those patients received an x-ray, two received CT scans, and eight received both x-rays and CT scans.

**Conclusion:** Quality assurance is a critical aspect of ensuring appropriate trauma transfers. While the mechanisms of injury for many patients were similar, there was variability regarding interventions, particularly imaging. By continuing to monitor these transfers, we can identify areas of improvement in the transfer process, implement measures that enhance the quality of care, and contribute to improved patient outcomes. Ultimately, the findings of this project have the potential to inform evidence-based guidelines, protocols, and metrics for trauma transfer, while ensuring timely, appropriate, and high-quality care for patients.

**AUTOMATIC DETECTION OF MULTIPLE  
CRANIOCEREBRAL TRAUMA BASED ON DENOISING  
DIFFUSION PROBABILISTIC MODEL**

Diya Sun, MD

Invited Moderator: Marcelo Riberio, PhD

Cranio-cerebral trauma is a serious threat to the lives of patients, and rapid localization of brain tissue injury is the key to trauma treatment. With the development of artificial intelligence, especially generative models, computer-assisted automatic detection models of multiple cranial trauma are increasingly emerging. There are supervised and unsupervised models according to the model training mode. Considering the high cost of manual trauma annotation on CT scans, unsupervised algorithms have shown advantages in practice. Based on a denoising diffusion probabilistic model, we propose a multi-trauma automatic detection method which can automatically generate an anomaly heat map that indicates the probability of occurring injuries on CT scans. The model consists of a gradually enhanced noise addition and denoising process based on deep neural networks. The neural network trained on health data without any annotation can encode information on healthy tissues. When confronting CT images of patients, the model can blur the traumatic area and reconstruct simulated healthy images of the patients, and the residual between the repaired image and the input image contains information about the damaged area. We conducted the experiment on CT images of cranial trauma, and the results showed that the model can effectively detect intracranial hemorrhage, intracranial gas, skull fractures, and other common injuries with high sensitivity. The DSC of intracranial hemorrhage segmentation can reach above 0.7, which is comparable to supervised algorithms of the same period. As far as we know, this is the first unsupervised multi-trauma detection model based on generative AI, providing a new idea for intelligent trauma care.

**ASSESSMENT OF TRAUMA QUALITY IMPROVEMENT  
ACTIVITIES IN ASIAN COUNTRIES**

Koji Morishita, MD

Invited Moderator: Marcelo Riberio, PhD

**Background:** The implementation of trauma care systems has improved patient outcomes, but international differences remain. Trauma care can only be improved if we recognize and clarify the differences between countries. Therefore, our study aimed to investigate the status of trauma quality improvement programs (TQIPs) in Asian countries.

**Methods:** An anonymous online survey was distributed to members of the Asian Collaboration for Trauma (ACT). The survey assessed the presence of the four elements of TQIPs recommended by the WHO (i.e., morbidity and mortality [M&M] conference, preventable death panel, trauma registry, and audit filter).

**Results:** Thirty-seven respondents from ten Asian countries (Japan, South Korea, Thailand, China, Philippines, Sri Lanka, Malaysia, Singapore, Taiwan, and India) responded to the survey. Thirty-four (91.3%) respondents held an M&M conference, 14 (37.8%) held a preventable death panel, 27 (73%) had a trauma registry, and 14 (37.8%) used an audit filter. Eight (21.6%) respondents from five countries reported meeting all four elements of TQIPs. Most respondents answered that preventable death panels and the trauma registry were critical aspects that should be improved. Twenty-seven (73 %) respondents reported that a trauma databank existed. The type of trauma databank was nationwide for 15 (40.5%) respondents (three countries), hospital-based for 14 (37.8%) respondents (five countries), and region-based for one (2.7%) respondent (one country). Seven (18.9%) respondents from one country reported that there was no trauma databank. Regarding the trauma registry, the two most frequent barriers were the absence of time (29 respondents, 78.4%) and financial difficulties (22 respondents, 59.5%).

**Conclusion:** It is important to accumulate data on TQIPs and trauma registries to further develop the Asian trauma system.