Scientific Session I - Raymond H. Alexander, MD Resident Paper Competition

Paper #1
January 10, 2024
8:30 am

DOES MEAN ARTERIAL PRESSURE AUGMENTATION IMPROVE NEUROLOGICAL RECOVERY OF BLUNT SPINAL CORD INJURIES: AN EAST MULTICENTER TRIAL

Aimee LaRiccia, DO*, Stephanie Doris, DO, Bhairav Shah, DO, Tanisha Kashikar, DO, Erik Teicher, MD FACS, Elena Lita, BS, Lindsey Perea, DO, FACS*, Jennifer L. Huber, DO*, H. Akin Enrol, MD, Malia Eischen, MD*, Michael S Farrell, MD, MS*, Lauren E. Colom, MD*, Stephanie Scott, MD*, Brian J. Daley, MD, MBA*, Gregory P. Schaefer, DO, FACS*, James M. Bardes, MD*, Brandi Palmer, MS, Melissa Moncrief, MD, William DeVoe, MD*, Ryan P. Dumas, MD*, Caitlin A. Fitzgerald, MD*, William M. Brigode, MD*, John D. Berne, MD*, Dalier Mederos, MD, Melissa B. Linskey Dougherty, MD*, Scott B. Armen, MD, FACS, FCCM*, Emily C. Alberto, MD, Asanthi M. Ratnasekera, DO, FACS*, Alison A. Smith, MD, PhD*, Ina Du, MD, Stephen P. Gadomski, MD*, Brad Dennis, MD, FACS*, Jeffry Nahmias, MD, MHPE, FACS, FCCM*, Claudia Alvarez, MD, Jennifer Schweinsburg, MD*, Salina M. Wydo, MD, FACS*, Carlos H. Palacio, MD, FACS*, Christopher Foote, MD, M. Chance Spalding, DO, PhD, FACS*, Joshua Hill, MD*
Grant Medical Center

Presenter: Aimee LaRiccia, DO

Discussant: Deborah Stein, MD, MPH – R Adams Cowley Shock Trauma Center

Objectives: Current treatment of blunt traumatic spinal cord injuries (SCI) includes maintaining elevated mean arterial blood pressures (MAP) to enhance perfusion to the spinal cord. Optimal hyperperfusion protocols and treatment algorithms have yet to be delineated due to a paucity of large volume prospective studies. This study aims to delineate factors, influencing neurologic outcomes following blunt SCI, hypothesizing MAP augmentation to improve the primary outcome of improvement in American Spinal Injury Association (ASIA) impairment score.

Methods: Prospective (10/1/2021 to 6/1/2023) multicenter study included blunt SCI patients age > 18 with complete neurologic examination on hospital arrival. Patients were divided into groups, improvement, and no-improvement, based on their change in ASIA score from arrival to hospital discharge.

Results: A total of 19 centers contributed 222 patients; 164 had pre and post ASIA scores. 36 patients (22%) had an improvement in their ASIA score and 128 (78%) had no improvement. There was no significant difference between groups regarding demographics and injury profile (Table 1). There was no statistical difference in the percentage of time patients spent at a MAP > 85mmHg during treatment (75% no improvement vs. 78% in the improvement, P = 0.91) (Table 2). Complications between the groups did show an increase in cardiac complications in the improvement group; specifically elevated troponins were found in 17.1% of patients in the improvement group compared to 7.8% in the no-improvement group (P =0.1) (Table 2).

Conclusions: Overall, 22% of all blunt SCI patients saw an improvement in their ASIA score. However, adherence to and length of MAP augmentation was not a statistically significantly different between groups. Additional examination into the treatment of these patients is required to continue to fully endorse MAP augmentation protocols.

	No Improvement n = 128	Improvement n = 36	P value
Demographics			
Age (mean)	52.1 (18.3)	53.3 (18.7)	0.74
BMI (mean)	29.5 (7.3)	32.0 (25.9)	0.56
Hospital LOS (mean)	16.5 (15.4)	21.4 (20.4)	0.15
ICU LOS (mean)	7.8 (8.2)	11.1 (16.5)	0.84
Mortality (%)	9.7%	5.6%	0.44
Hospital Transfer (%)	32.4%	22.6%	0.24
Injury Specifics			
ISS (mean)	25.1 (15.0)	23.4 (8.7)	0.61
AIS head (mean)	2.3 (1.4)	2.2 (1.3)	0.84
AIS c-spine (mean)	3.9 (1.0)	3.9 (0.79)	0.91
AIS T-spine (mean)	3.7 (1.3)	3.6 (1.62)	0.87
AIS L-spine (mean)	2.6 (1.2)	3.3 (1.5)	0.27
AIS Abdomen (mean)	2.3 (1.05)	2.2 (1.3)	0.85
AIS Chest (mean)	2.8 (1.3)	2.8 (1.1)	0.96
Cervical spine injury (%)	79.5%	77.8%	0.82
Thoracic (spine) injury (%)	29.9%	16.7%	0.11
Lumbar spine injury (%)	8.7%	13.9%	0.35
MOI (%)			
Fall	44.4%	44.9%	0.82
MVC	30.6%	33.1%	
Other	19.4%	11.8%	
MCC	2.8%	4.7%	
Pedestrian struck	2.8%	3.9%	
Assault	0.0%	1.6%	
Discharge Location (%)			
Inpatient rehabilitation	58.2%	58.3%	0.054
SNF	3.3%	16.7%	
LTACH	9.0%	5.6%	
Home	20.5%	13.9%	

Table 1: Demographics and injury profile. ( ) indicates standard deviation. ISS = injury severity score, LOS = length of stay, AIS = abbreviated injury score, MVC = motor vehicle accident

	No Improvement n= 128	Improvement n = 36	P value
Trauma Bay Labs/Vitals (mean)			
Heart rate	82.0 (18.8)	81.7 (22.2)	0.76
Systolic BP	131.6 (30.8)	134 (29.1)	0.85
Diastolic BP	78.9 (20.5)	81.8 (20.0)	0.62
MAP	94.9 (23.3)	95.7 (23.5)	0.99
Respiratory Rate	20.0 (10.4)	20.6 (8.0)	0.51
Lactate	2.1 (1.2)	2.3 (1.5)	0.62
pH	7.3 (0.1)	7.3 (0.05)	0.43
Creatinine	2.06 (10.6)	1.27 (2.1)	0.73
Hgb	13.2 (1.9)	12.9 (2.2)	0.68
MAP specifics			
MAP duration (mean hours)	98.6 (94.21)	113.0 (100.93)	0.21
% time MAP > 85 (mean)	0.75 (0.25)	0.78 (0.16)	0.91
Complications			
Atrial Fibrilation (%)	6.70%	11.40%	0.35
Ventricular tachycardia (%)	1.70%	5.70%	0.19
Elevated troponin	7.80%	17.10%	0.1
Cardiology consultation	14.20%	25.70%	0.11

Table 2: Specifics of patient presentation to a trauma center, MAP treatment specifics and Complications. ( ) indicates standard deviation

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Paper #2
January 10, 2024
8:45 am

TIME IS TISSUE: OPERATIVE INTERVENTION TIMING AND MORTALITY IN EMERGENCY GENERAL SURGERY PATIENTS

David Silver, MD, MPH, Jamie Beiriger, BS, Liling Lu, MS, Katherine Reitz, MD, MSc, Yekaterina Khamzina, MD, Matthew D. Neal, MD, Andrew B. Peitzman, MD*, Joshua B. Brown, MD, MSc, FACS*
University of Pittsburgh Medical Center

Presenter: David Silver, MD, MPH

Discussant: Rondi Gelbard, MD – University of Alabama Birmingham

Objectives: Emergency general surgery (EGS) patients often require time-sensitive interventions. Limited data are published to guide operating room triage decisions and resource allocation in this population. This study investigated the relationship between the time from hospital arrival to operative intervention and mortality among EGS patients.

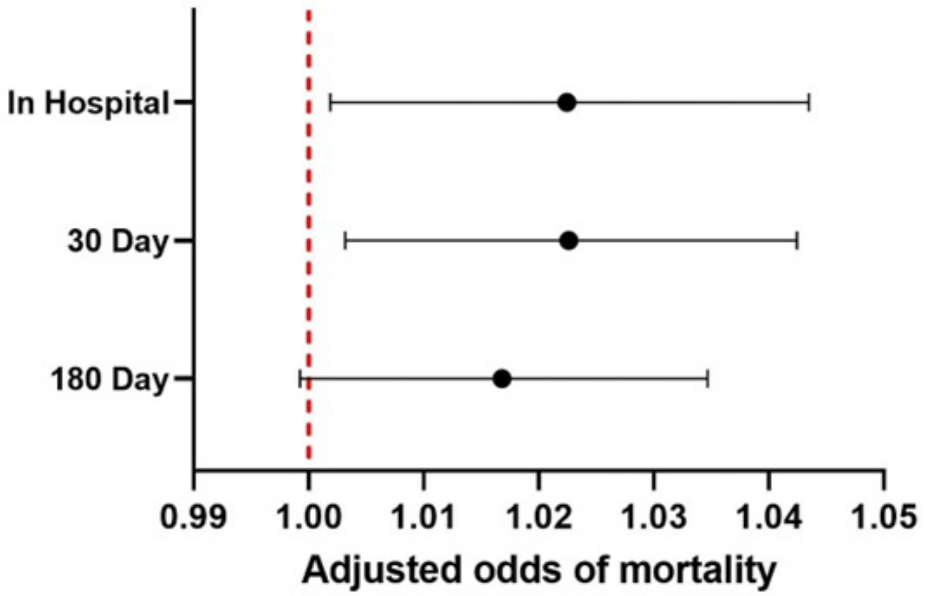
Methods: We conducted a retrospective cohort study using an EGS registry at a quaternary referral center including adults who underwent operative intervention for a primary AAST-defined EGS diagnosis between 2021-2023 by the Acute Care Surgery faculty group. Patients with surgery >48h from admission were excluded due to ambiguity of surgical timing/urgency. The exposure of interest was defined as the time from the first vital sign capture to skin incision. The association between operative timing and in-hospital, 30-day, and 180-day mortality was determined from a hierarchical multivariable model adjusted for patient demographics, comorbidities, and physiologic derangement with clustering at the individual surgeon level.

Results: A total of 611 patients were included (Table). Median time to operative intervention was 293.5min (IQR 166-442). The crude in-hospital mortality rate was 10.2%, and 30-day mortality rate was 10.9%. Regression modeling showed that for every 30 minutes of delay, there was 2.2% increased odds of in-hospital mortality (aOR 1.022; 95%CI 1.001----1.043, p=0.32). This effect was also observed for 30-day mortality, but no longer significant at 180 days (Figure).

Conclusions: Our findings suggest prompt operative intervention is associated with lower mortality for in-hospital and 30-day mortality among EGS patients. Future work to identify heterogeneity of treatment effect among different EGS populations is warranted. These results may inform benchmarking and local guidelines for triaging surgical interventions in the EGS population to help reduce mortality.

Study population characteristics and outcomes.	
N	611
Age, median (IQR)	58 (41, 69)
Sex, male, No. (%)	305 (50.2%)
CCI	1(0,2)
Initial HR, median (IQR)	89 (76, 105)
Initial RR, median (IQR)	18 (16, 21)
Initial SBP, median (IQR)	127 (114,143)
Initial Temp, median (IQR)	36.8 (36.4, 37.1)
Interfacility Transfer No. (%)	301 (49.3%)
Door to OR Time, median (IQR)	293 (166, 442)
Laparotomy No. (%)	296 (48.4%)
AAST Diagnosis No. (%)	
Upper GI Bleed	26 (8.0%)
Incarcerated Hernia	133 (40.7%)
Colitis	29 (8.9%)
Ischemic Bowel	52 (15.8%)
Soft Tissue	57 (17.4%)
Perforated Viscus	30 (9.2%)
In Hospital Mortality, No. (%)	62 (10.2%)
30 Day Mortality, No. (%)	66 (10.9%)
60 Day Mortality, No. (%)	72 (11.8%)

CCI, Charlson Comorbidity Index; HR, Heart Rate; RR Respiratory Rate; SBP, Systolic Blood Pressure; Temp, temperature; OR, operating room



Adjusted odds ratio and 95% confidence interval for association between each 30-minute increase in time to operation and mortality. Vertical red dotted line indicates odds ratio of 1.0.

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Paper #3
January 10, 2024
9:00 am

PREHOSPITAL ETCO2 PREDICTS HYPERFIBRINOLYSIS IN INJURED PATIENTS: IMPLICATIONS FOR EARLY USE OF ANTIFIBRINOLYTICS IN TRAUMA

TJ Schaid, MD, Angela Sauaia, MD, PhD, Courtney Wham, MIS, Paramedic, Theresa Morin, MA, Kevin McVaney, MD, Mitchell Cohen, MD, FACS*, Robert McIntyre Jr., MD, Shane Urban, BSN, RN*, Alexis Cralley, MD, Ernest Eugene Moore, MD*, Eric M. Campion, MD, FACS*
Denver Health Medical Center

Presenter: TJ Schaid, MD

Discussant: Carrie Valdez, MD – The Ohio State University Wexner Medical Center

Objectives: Empiric use of prehospital antifibrinolytics in trauma is controversial, but it is clear that earlier administration is more effective. With hemorrhagic shock driving trauma-induced hyperfibrinolysis (HF) and end-tidal CO_2 ($ETCO_2$) emerging as a non-invasive indicator of hemorrhagic shock, we aimed to investigate the performance of prehospital $ETCO_2$ in predicting HF in injured patients.

Methods: This was a prospective, observational study from two Level 1 Trauma Centers. Intubated and non-intubated adults with prehospital hypotension (SBPâ‰¤90mmHg) transported by ground ambulance were included, and prehospital $ETCO_2$ was measured either in-line with the ventilator circuit or by nasal cannula capnography. Thromboelastography (TEG) was used to identify HF as LY30>3%. HF-predicting power of $ETCO_2$ was compared with that of prehospital SBP and shock index (SI) using ROC curve analysis and the DeLong method. The Youden index was used to define optimal cut-offs.

Results: Of 138 patients included, 13 (9%) had HF on arrival, of which eight (62%) were non-intubated, nine (69%) required massive transfusion, and eight (62%) died (Table). Minimum prehospital $ETCO_2$ outperformed both lowest prehospital SBP and maximum prehospital SI in predicting HF (Figure). None of the prehospital measures were predictive of any other TEG abnormality. By Youden index, an $ETCO_2$ <17mmHg had a positive predictive value of 27% and negative predictive value of 95% for HF (Figure). Even when including both hypo- and normotensive patients (n=234), $ETCO_2$ remained a superior predictor of HF (area under ROC curve 0.84 vs. 0.60 and 0.67 for SBP and SI, respectively, $P<0.05$).

Conclusions: $ETCO_2$, whether measured in intubated or non-intubated patients, is an accurate, objective, inexpensive, non-invasive prehospital measure of HF risk that could be employed to guide the selective use of early antifibrinolytics in trauma.

Variable	Total (n=138)	No HF (n=125)	Yes HF (n=13)	P-value
Age	37 (26-52)	37 (27-52)	38 (21-54)	0.85
Male Sex	108 (78%)	95 (76%)	13 (100%)	0.046
Blunt Mechanism	85 (62%)	81 (65%)	4 (31%)	0.02
TBI	40 (29%)	37 (30%)	3 (23%)	0.62
Prehospital Intubation	22 (16%)	17 (14%)	5 (38%)	0.02
Min Prehospital SBP	0 (0-0)	0 (0-0)	0 (0-48)	0.12
Max Prehospital Shock Index	1.38 (0.86-1.56)	1.36 (0.87-1.56)	1.42 (1.3-1.56)	0.59
Min Prehospital $ETCO_2$	26 (20-31)	26 (20-32)	17 (12-28)	0.01
ISS	17 (9-27)	16 (8-27)	26 (17-42)	0.01
Arrival Base Excess	-7.5 (-11.5 to -3.9)	-6.9 (-9.4 to -3.3)	-13.2 (-17.8 to -7.8)	0.02
ED ACT>128 seconds*	18 (15%)	14 (13%)	4 (36%)	0.03
ED Angle≤65°	18 (13%)	14 (11%)	4 (31%)	0.046
ED MA<55mm	17 (12%)	12 (10%)	5 (39%)	0.003
Massive Transfusion	21 (15%)	12 (10%)	9 (69%)	<0.0001
Hemorrhage Control Procedure	53 (38%)	43 (34%)	10 (77%)	0.003
ICU-free days	26 (20-28)	26 (21-28)	0 (0-25)	0.0005
Ventilator-free days	28 (24-28)	28 (26-28)	0 (0-28)	0.0003
Mortality	19 (14%)	11 (9%)	8 (62%)	<0.0001

Table. Baseline characteristics and outcomes among hypotensive patients presenting without hyperfibrinolysis (No HF) and with hyperfibrinolysis (Yes HF). Values for all continuous variables are the median (interquartile range).

*Sixteen patients (14 No HF and 2 Yes HF) were missing ACT values from their rapid TEGs

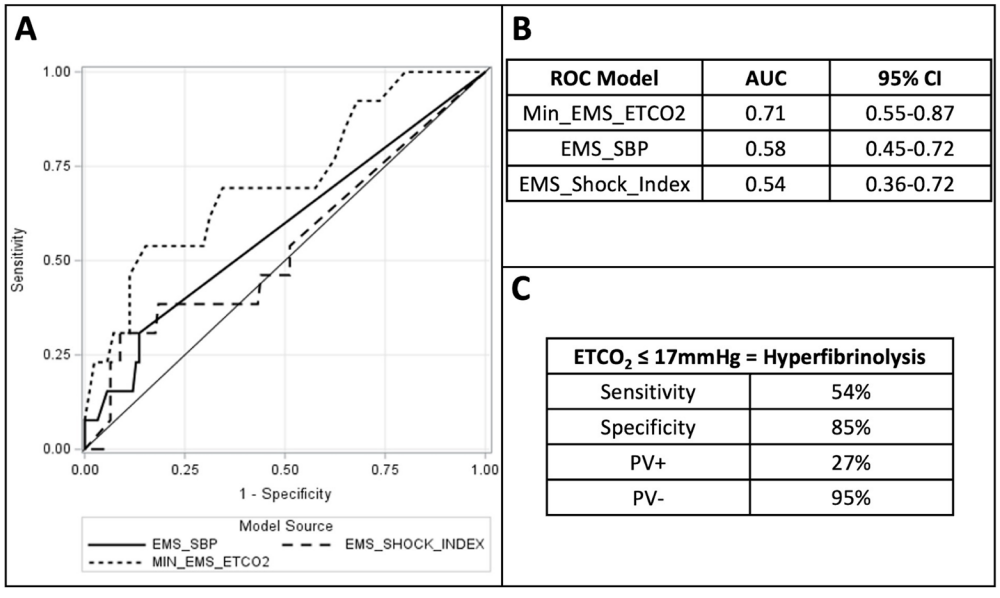

Figure. Hyperfibrinolysis (HF)-predicting power of prehospital $ETCO_2$ in hypotensive patients. A: ROC curves for each prehospital measure. B: Area under ROC curves (AUC) with 95% confidence intervals (CI). C: Test characteristics for $ETCO_2$â‰¤17mmHg predicting HF on arrival. Positive predictive value (PV+), negative predictive value (PV-).

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Paper #4
January 10, 2024
9:15 am

THE DIRECT RBC EFFECT ON THROMBOSIS IS AFFECTED BY TISSUE FACTOR AND PHOSPHATIDYLSERINE

Adam D. Price, MD, Taylor Wallen, MD*, Matthew R. Baucom, MD, Ryan C. Chae, MD, Rebecca Schuster, MS, Lisa England, RVT, Timothy A. Pritts, MD, PhD*, Michael Goodman, MD, FACS*
University of Cincinnati

Presenter: Adam D. Price, MD

Discussant: Lucy Z. Kornblith, MD – USCF – San Fransisco General Hospital

Objectives: Prior literature has established a role of Red Blood Cells (RBCs) in the initiation and propagation of thrombosis. Our previous work suggests that post-transfusion hypercoagulability or acute lung injury may occur secondary to the effects of stored RBCs. The accumulation of microparticles (MP) in stored blood has been shown to contribute to RBC aggregability. We hypothesized that the age-dependent aggregability of RBCs may involve Tissue Factor (TF) and phosphatidylserine mechanisms.

Methods: Human whole blood (WB) was aged for 21 days. Components including platelet-rich plasma and packed RBC (pRBC) were isolated and aged similarly. Fresh and aged WB and pRBC underwent impedance aggregometry utilizing arachidonic acid (ASA), ADP, collagen, calcium (STARTEM) and tissue factor-based (EXTEM) agonists. Aged pRBC were incubated with annexin V, a known phosphatidylserine binding agent, for a 20-minute period in order to block MP-associated phosphatidylserine. Aged pRBC then underwent impedance aggregometry with a TF-based agonist to determine if the mechanism of TF-induced RBC aggregability is dependent on phosphatidylserine.

Results: RBC aggregation of pRBC was significantly higher than WB when utilizing a TF agonist. This effect persisted when comparing WB and pRBC aged to 21 days. RBC aggregability in WB was greater or comparable to pRBC when utilizing non-TF-based agonists followed by time-dependent loss of RBC aggregability when aged to 21 days (Figure 1). Annexin V exposure resulted in a significantly reduced aggregability response of aged pRBC with a TF-based agonist (Figure 2).

Conclusions: TF induces an enhanced RBC aggregability that persists in aged, stored pRBC. Phosphatidylserine appears to play an integral role in the TF-induced RBC aggregation response. Future work will need to further investigate the mechanisms of TF-induced RBC aggregation to mitigate the prothrombotic response to RBC transfusion.

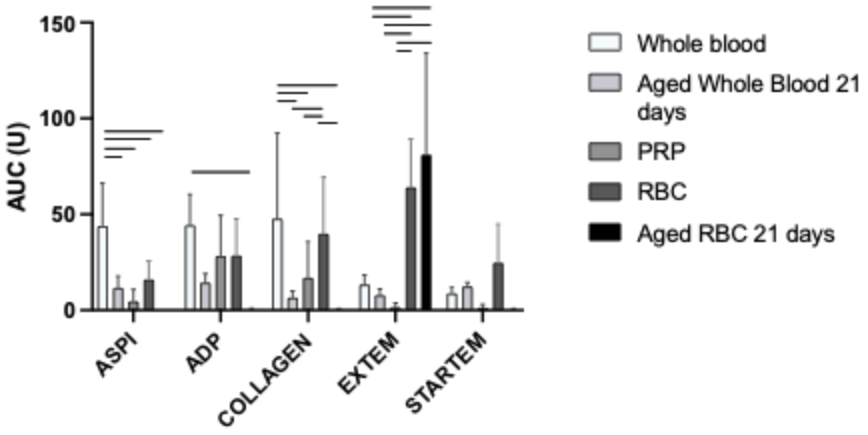

Figure 1. WB demonstrates higher or comparable RBC aggregability to pRBC when utilizing arachidonic acid, ADP, collagen, or calcium-based (STARTEM) agonists on impedance aggregometry, with diminishing aggregability of pRBC with aging. TF-based (EXTEM) agonist demonstrates higher pRBC aggregability than WB, with persistence of aggregation with aging ($p<0.01$).

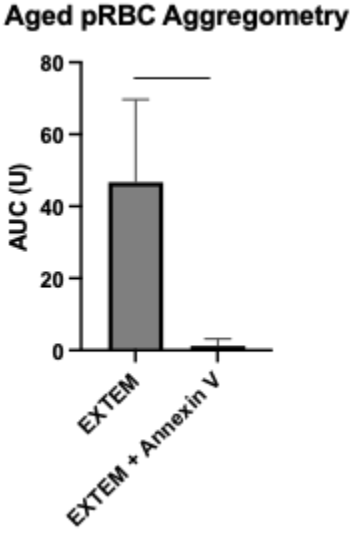

Figure 2. pRBC aged 21 days utilizing a TF-based (EXTEM) agonist on impedance aggregometry demonstrates significantly reduced aggregability following incubation with annexin V, a known phosphatidylserine binding agent when compared to no annexin V exposure ($p<0.01$).

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Paper #5
January 10, 2024
9:30 am

CYTOPROTECTIVE APC AND FFP AS THERAPIES FOR THE ENDOTHELIOPATHY OF TRAUMA: SEPARATE OR IN COMBINATION?

Otto N. Thielen, MD, Preston Stafford, MS, Marguerite Kelher, M.S., Sanchayita Mitra, BS, TJ Schaid, MD, William Hallas, MD, Lauren T. Gallagher, MD, Angela Sauaia, MD, PhD, Ernest Eugene Moore, MD*, Kirk Hansen, PhD, Angelo D'Alessandro, PhD, Laurent Mosnier, PhD, John Griffin, PhD, Mitchell Cohen, MD, FACS*
University of Colorado, Aurora

Presenter: Otto N. Thielen, MD

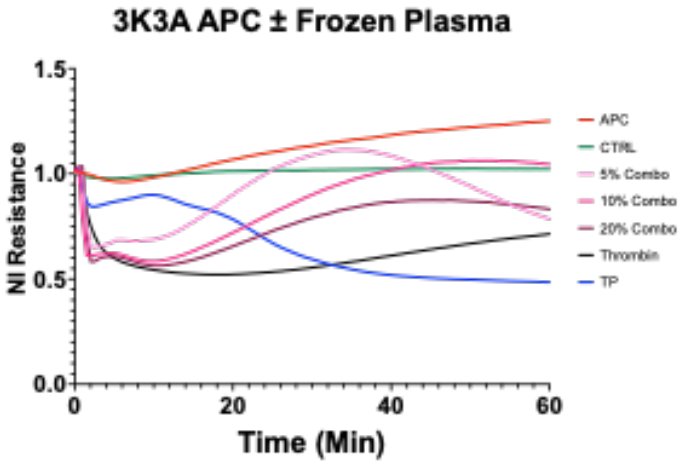
Discussant: Timothy Pritts, MD, PhD – University of Cincinnati

Objectives: Although both fresh frozen plasma (FFP) and cytoprotective aPC (APC) have been shown to mitigate the endotheliopathy of trauma (EOT), optimal therapeutics are currently unknown. Our aim was therefore to determine optimal therapies to mitigate EOT by investigating the effectiveness of APC with and without plasma-based resuscitation strategies.

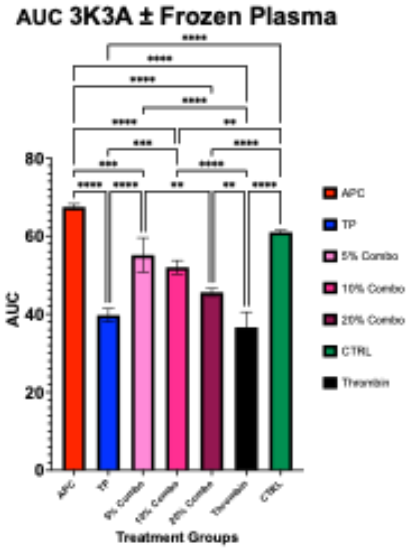
Methods: Electric cell-substrate impedance sensing (ECIS) was used to measure real time permeability changes in endothelial cells. Cells were treated with a 2 μg/mL solution of APC 30 minutes prior to stimulation with *ex vivo* plasma taken from severely injured trauma patients (ISS>15 and BD <-6) (TP). FFP was added concomitantly with TP. Cells treated with thrombin and untreated cells were included in this study as control groups.

Results: Pre-incubation with APC alone inhibited endothelial cell permeability induced by *ex vivo* trauma plasma to a greater degree than all other treatment groups ($p<0.001$) (Figures). Within the FFP groups, treatment with FFP and 10% TP had a dose-dependent response. Higher concentrations of FFP induced greater permeability.

Conclusions: Previously, FFP has been shown to have cytoprotective effects on endothelial cells treated with thrombin or vascular endothelial growth factor. Our data shows that FFP, in a post trauma environment, may blunt the protective effects of APC as FFP may contain proinflammatory damage-associated molecular patterns (DAMPs) and/or thrombin which is variable based on donor and worsens during storage. Our data also shows that APC alone mitigated the EOT to a greater degree than FFP with or without APC. While further exploration is needed of the pro inflammatory variability in FFP, our data suggests that APC represents a potentially superior therapeutic treatment for dysregulated thromboinflammation for injured patients.



ECIS Tracing of APC group Vs. Combination FFP + APC groups in addition to untreated control group, positive control group (Thrombin), and TP group.



AUC of APC group Vs. Combination FFP + 3K3A groups in addition to untreated control group, positive control group (Thrombin), and TP group.

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Paper #6
January 10, 2024
9:45 am

THE NO CLOT VTE STUDY IN HIGH-RISK PEDIATRIC TRAUMA PATIENTS

Amanda Witte, MD, Kyle Van Arendonk, MD, PhD, Richard A. Falcone, Jr., MD, MPH*, Suzanne Moody, MPA, Heather Hartman, MD, Emily Evans, BS, Rajan K Thakkar, MD*, Kelli Patterson, DO, MS, MPH, Peter Minneci, MD, MHSc, Grace Mak, MD, Mark B Slidell, MD, MPH*, MacKenton Johnson, BS, Matthew Landman, MD, MPH*, Troy Markel, MD, Charles Leys, MD, Linda Cherney Stafford, MPH, Jessica Draper, NP, David Foley, MD*, Cynthia Downard, MD, Tracy Skaggs, APRN, David Gourlay, MD*, Peter Ehrlich, MD, MSc, H BSc*
Children's Wisconsin, Medical College of Wisconsin, Milwaukee, Wisconsin

Presenter: Amanda Witte, MD

Discussant: Elliott Haut, MD, PhD – The Johns Hopkins Hospital

Objectives: The indications, safety, and efficacy of chemical VTE prophylaxis (cVTE) in pediatric trauma patients remain unclear. A set of high-risk criteria to guide cVTE use was recently recommended. To date these criteria have not been evaluated in a prospective trial. The purpose of this study was to examine high-risk criteria and cVTE use in a prospective multi-institutional study of pediatric trauma patients. We hypothesized that cVTE would be safe and reduce the incidence of VTE.

Methods: Pediatric patients were enrolled at eight level one pediatric trauma centers from October 2019 to October 2022 and given cVTE with enoxaparin based on mutually agreed upon high-risk criteria (Fig 1). Patients were grouped based on timing of cVTE (within 24 hours, after 24 hours, or never). Outcomes were bleeding and 30-day VTE events. Univariate and multivariate analysis was performed.

Results: Among the 460 patients enrolled, median injury severity score (ISS) was 23 and median number of high-risk factors was 3 (IQR 2-4). There were 28 VTE events among 25 patients (5.4%). Patients with VTE had a median of 4 (IQR 3-5) high-risk criteria, the most common being ICU stay over 48 hours (92%) and traumatic brain injury (64%). 56% of patients received cVTE; 14% received cVTE within 24 hours of admission. Patients who received cVTE after 24 hours had more high-risk factors and higher ISS ($p<0.05$). The most common reason for delayed cVTE was intracranial bleed (32%). VTE occurred in 1.6% of those receiving cVTE within 24 hours, 6.7% of those receiving cVTE after 24 hours, and 5.4% of those who had no cVTE ($p=0.34$)(Fig 2). No bleeding complications were observed while on cVTE.

Conclusions: In this prospective study, use of cVTE appeared safe. Using this set of high-risk criteria we could not demonstrate VTE risk reduction between those who received cVTE and those who did not. Further subgroup analysis is ongoing to refine the high-risk criteria.

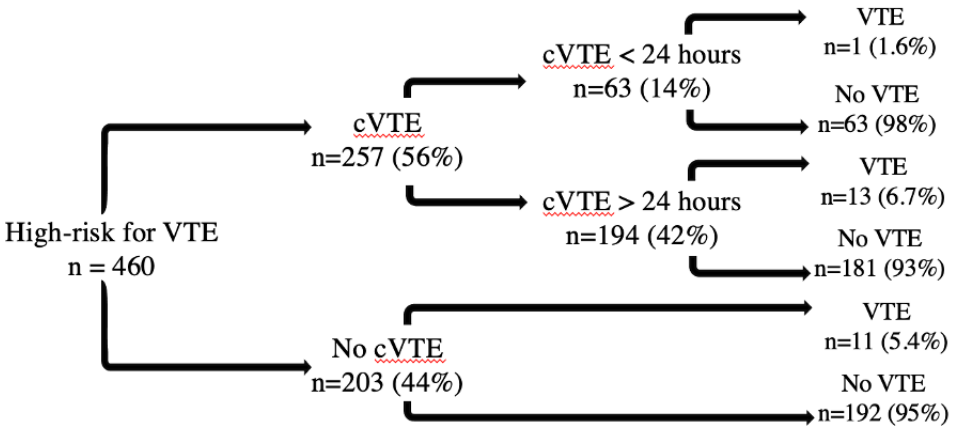
High-Risk Criteria:

- Patient not expected to ambulate within 48 hours post-injury AND > 8 years age with one of the following OR ≤ 8 years age with 2 or more of the following:
  - CVL
  - Spinal cord injury
  - Moderate-severe TBI
  - Non-weight bearing fractures
  - Vascular injury
  - Expected ICU stay > 48 hours
  - History of shock (need for transfusions, CPR, inotropes)
  - Major thoracoabdominal operation
  - History of VTE
  - History of chronic inflammatory diseases (IBD, vasculitis, nephrotic syndrome)
  - Current use of estrogen
  - Family history of VTE (1st degree relative)
  - Morbid obesity

High-Risk Treatment:

- Mechanical prophylaxis for all ICU patients started on admission
- Chemical prophylaxis within 24 hours of admission
- LMWH (0.5mg/kg SQ BID up to max 30mg BID)

High-risk criteria and treatment guidelines.



cVTE status and rate of VTE.

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #7
January 10, 2024
10:30 am

OUTCOMES OF TRAUMATICALLY INJURED PATIENTS AFTER NIGHTTIME TRANSFER FROM THE INTENSIVE CARE UNIT

Devin J. Clegg, MD, Jacob Balmer, MD*, Shaun Rowe, PharmD, MS, BCCP, FNCS, FCCP,
Brian J. Daley, MD, MBA*
University of Tennessee Medical Center-Knoxville

Presenter: Devin J. Clegg, MD

Discussant: D'Andrea Joseph, MD – NYU- Langone Long Island

Objectives: Prior studies have associated nighttime transfer of patients out of the intensive care unit (ICU) with increased morbidity. This study sought to examine this relationship in traumatically injured patients, as this has not been previously performed.

Methods: Retrospective review of traumatically injured patients admitted to a Level I Trauma Center's ICU from 1/2021-9/2022 was performed. "Day shift" (DS) was defined as 7:00AM-7:00PM and (NS) as 7:01PM-6:59AM. Time of transfer completion was based on time of patient arrival to the destination unit. Univariate analysis compared patients with completed transfers during DS and NS. A multivariate logistic regression model was conducted predicting for readmission to the ICU.

Results: A total of 1800 patients were included in the analysis, with 608 patients that had completed transfers during NS, and 1192 during DS. Both groups were similar, with no significant differences in age, sex, injury severity score (ISS), mechanism of injury, or median total comorbidities. The NS group had a longer median time to transfer completion (10.1 [IQR 5.5, 13.6] hours vs. 5.1 [IQR 2.9, 8.4] hours; $p<0.001$). A significantly higher proportion of the NS group had a readmission to the ICU (60 [10.0%] vs. 86 [7.0%]; $p=0.03$) or a major complication (96 [15.9%] vs. 147 [12.3%]; $p=0.04$). When controlling for age, comorbidities, ISS, time to bed assignment and to transfer completed, and ICU length of stay, transfer completion during NS was associated with 1.6 times higher odds of having an ICU readmission (OR 1.56 [95% CI 1.1-2.3]; $p=0.03$).

Conclusions: Trauma patients transferred from the ICU during NS experienced longer delays, readmission to the ICU, and major complications significantly more often. With increasing hospital bed shortages across the country, patient transfers must be analyzed to minimize worsened outcomes, especially in the traumatically injured patient.

Variable	Estimate	Standard Error	Odds Ratio	95% Confidence Interval	*P* value
Intercept	-3.93	0.50	--	--	**<0.001**
Age	0.02	0.01	1.02	1.01, 1.03	**0.001**
Diabetes mellitus	-0.49	0.25	0.62	0.38, 1.01	0.05
Functionally dependent health status	0.25	0.24	1.29	0.80, 2.05	0.29
Chronic obstructive pulmonary disorder	-0.28	0.82	0.76	0.15, 3.78	0.74
Alcohol use disorder	1.02	0.42	2.79	1.23, 6.33	**0.02**
Chronic renal failure	0.81	0.80	2.24	0.46, 10.81	0.32
Injury Severity Score	-0.02	0.01	0.98	0.96, 1.00	0.06
Intensive care unit length of stay	0.18	0.02	1.20	1.16, 1.24	**<0.001**
Time from requested transfer to bed assignment	0.03	0.04	1.03	0.95, 1.11	0.46
Time from requested transfer to transfer completion	-0.04	0.04	0.96	0.89, 1.03	0.25
Transfer completed during night shift	-0.45	0.20	1.56	1.05, 2.33	**0.03**

Notes. All odds ratios expressed as predictors of unanticipated readmission to the intensive care unit. Beta=0 p<0.0001, Hosmer and Lemeshow Goodness-of-fit p=0.42.
Bold indicates statistical significance $p < 0.05$.

Multivariate logistic regression model predicting for unanticipated readmission to the intensive care unit.

Variable	Night Shift n=608	Day Shift n=1192	*P* value
Unplanned intubation	28 (4.6%)	40 (3.4%)	0.18
Complications			
Stroke	3 (0.5%)	7 (0.6%)	> 0.99
Cardiac arrest with CPR	4 (0.7%)	8 (0.7%)	> 0.99
Unplanned operating room trip	18 (3.0%)	22 (1.9%)	0.12
Deep vein thrombosis	5 (0.8%)	17 (1.4%)	0.28
Pulmonary embolism	8 (1.3%)	7 (0.6%)	0.10
Myocardial infarction	4 (0.7%)	10 (0.8%)	0.78
Postoperative hemorrhage	0 (0%)	1 (0.1%)	> 0.99
Acute kidney injury	5 (0.8%)	10 (0.8%)	0.98
Acute respiratory distress syndrome	3 (0.5%)	5 (0.4%)	> 0.99
Catheter related urinary tract infection	2 (0.3%)	4 (0.3%)	> 0.99
Catheter related blood stream infection	1 (0.2%)	1 (0.1%)	> 0.99
Total complications*	0 (0, 0)	0 (0, 0)	**0.03**
Major complication	96 (15.9%)	147 (12.3%)	**0.04**

Notes. * Denotes value expressed as median (25^{th} and 75^{th} interquartile range).
Bold indicates statistical significance $p < 0.05$.

Univariate analyses comparing patients transferred from the intensive care unit during night shift and day shift and the development of complications. Major complications represented as patients that underwent unplanned readmission to the intensive care unit, unplanned intubation, cardiac arrest with CPR, and death.

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #8
January 10, 2024
10:45 am

CONCORDANCE OF ABBREVIATED INJURY SCALE AND AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA ORGAN INJURY SCALE IN PATIENTS WITH ABDOMINAL TRAUMA

Jeffrey Santos, MD, Shelby Kunz, MD, Areg Grigorian, MD, Stephen Park, MD, Kazuhide Matsushima, MD*, Liz Penaloza-Villalobos, MD, Xian Luo-Owen, MD, PhD, Kaushik Mukherjee, MD, MSCI, FACS, Claudia Alvarez, MD, Jeffry Nahmias, MD, MHPE, FACS, FCCM*
University of California, Irvine

Presenter: Jeffrey Santos, MD

Discussant: William Chiu, MD – University of Maryland School of Medicine

Objectives: The Abbreviated Injury Scale (AIS) is widely adopted as a measure of body region-specific trauma injury severity. In contrast, the American Association for the Surgery of Trauma Organ Injury Scale (AAST OIS) provides organ-specific details of injury but is not readily available in trauma databases. As such, previous researchers have used AIS as a surrogate for OIS. This study aims to assess the concordance of the AIS-abdomen with AAST OIS Grade for liver and spleen injuries.

Methods: This multicenter retrospective study was performed at three trauma centers. Adult trauma patients presenting between July 2020-June 2022 with AAST OIS grade III-V injury to the liver and/or spleen were included. AAST OIS grade for each organ was compared to AIS-abdomen by evaluating the percentage of AAST OIS grade correlating with each AIS score (e.g., AAST OIS grade III correlating with AIS score of 3). Chi-square tests were used to determine overall correlation with statistical significance set at $p<0.05$.

Results: Of 472 patients, 274 with an AAST OIS Grade >3 liver injury and 205 Grade >3 spleen injury were analyzed. AAST OIS Grade III liver injury had an 85.5% concordance rate with AIS 3, Grade IV had a concordance rate of 71% with AIS 4, and Grade V had a 90.9% concordance rate with AIS 5. There was an overall lack of concordance for liver injury ($p<0.001$). AAST OIS Grade III, IV, and V had concordances rates of 89.7%, 87.8%, and 87.3%, respectively. There was an overall lack of concordance for spleen injury ($p<0.001$).

Conclusions: While AIS is commonly used as a measure of injury severity, it does not appear to be interchangeable with OIS for research methodology. Thus, AAST OIS should be adopted for inclusion in trauma databases (e.g., TQIP) to allow for more accurate description of organ injury and enhanced national research and quality improvement projects.

	AIS Abdomen				
AAST OIS Grade – Liver	3	4	5	6	**Total**
III	130 (85.5%)	16 (10.5%)	6 (3.9%)	0 (0%)	152
IV	16 (16%)	71 (71%)	12 (12%)	1 (1%)	100
V	0 (0%)	1 (4.5%)	20 (90.9%)	1 (4.5%)	22
Total	146	88	38	2	274

AAST = American Association for the Surgery of Trauma, AIS = Abbreviated Injury Scale
Reported as n (% of AAST OIS grade)
Chi-Square test: p <0.001

Table 1. Concordance between AAST Organ Injury Scale (OIS) Grade for liver versus Abbreviated Injury Scale (AIS) for the abdomen

	AIS Abdomen				
AAST OIS Grade – Spleen	3	4	5	6	**Total**
III	61 (89.7%)	6 (8.8%)	1 (1.5%)	0 (0%)	68
IV	5 (6.8%)	65 (87.8%)	4 (5.4%)	0 (0%)	74
V	2 (3.2%)	6 (9.5%)	55 (87.3%)	0 (0%)	63
Total	68	77	60	0	205

AAST = American Association for the Surgery of Trauma, AIS = Abbreviated Injury Scale
Reported as n (% of AAST OIS grade)
Chi-Square test: p <0.001

Table 2. Concordance between AAST Organ Injury Scale (OIS) Grade for spleen versus Abbreviated Injury Scale (AIS) for the abdomen

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #9
January 10, 2024
11:00 am

WHOLE BLOOD STORAGE DURATION ALTERS FIBRINOGEN LEVELS AND CLOT FORMATION

Ryan C. Chae, MD, Christopher Nguyen, BS, Chad Archdeacon, Stephanie Sisak, MD, Adam D. Price, MD, Emma Perez, Rebecca Schuster, MS, Alex Lentsch, PhD, Charles Caldwell, PhD, Michael Goodman, MD, FACS*, Timothy A. Pritts, MD, PhD*
University of Cincinnati

Presenter: Ryan C. Chae, MD

Discussant: Joshua Hazelton, DO – WellSpan York Hospital

Objectives: Fibrinogen is increasingly recognized for its ability to correct both coagulopathy and endotheliopathy after hemorrhage. Whole blood (WB), which contains fibrinogen, is commonly transfused to bleeding patients. However, the effect of storage duration on the amount and activity of fibrinogen in WB is unknown. We hypothesized that WB storage leads to altered fibrinogen amount and activity.

Methods: WB from C57BL/6 male mice was stored in CP2D at 4°C (n=5 for all groups). Fresh citrated WB served as control. On days 0, 3, 7, and 10, clotting capacity was measured with rotational thromboelastometry (ROTEM). Platelet poor plasma was isolated from stored WB and analyzed for fibrinogen levels and thrombin generation. A p-value<0.05 was considered significant.

Results: Plasma fibrinogen levels decreased over the storage period (FIGURE 1). In a storage duration-dependent fashion, WB demonstrated prolongation in extrinsically activated (EXTEM) clotting time and clot firmness time with a decreased alpha angle. However, the maximum clot firmness (MCF) was maintained. When platelet contribution was blocked (FIBTEM), MCF decreased over the duration of storage with a subsequent rise in the calculated platelet contribution to MCF (FIGURE 2). Endogenous thrombin potential and peak thrombin production were similar or increased compared to fresh WB but lag and peak times were prolonged and velocity was slower.

Conclusions: Stored WB suffers a storage duration dependent fibrinogen deficiency as evidenced by decreased fibrinogen levels, reduced FIBTEM MCF, and increased platelet contribution to clot despite decreased aggregability. Overall thrombin generation is maintained in stored WB, though its production is slower. With fibrinogen and platelet aggregability decreased but overall thrombin generation preserved, future studies will be necessary to identify the factors in stored WB responsible for the maintained coagulability.

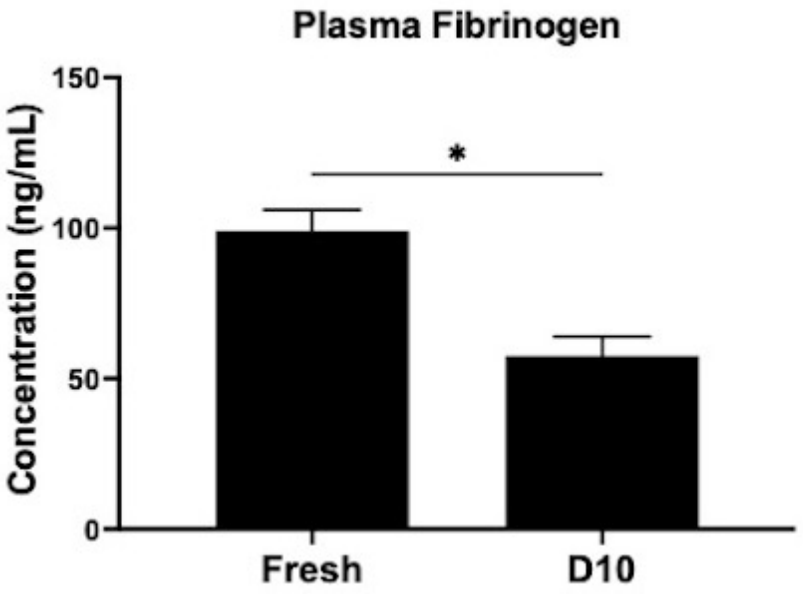


FIGURE 1: Plasma fibrinogen level for fresh compared to D10 stored WB. N=5 for all groups. *p<0.05.

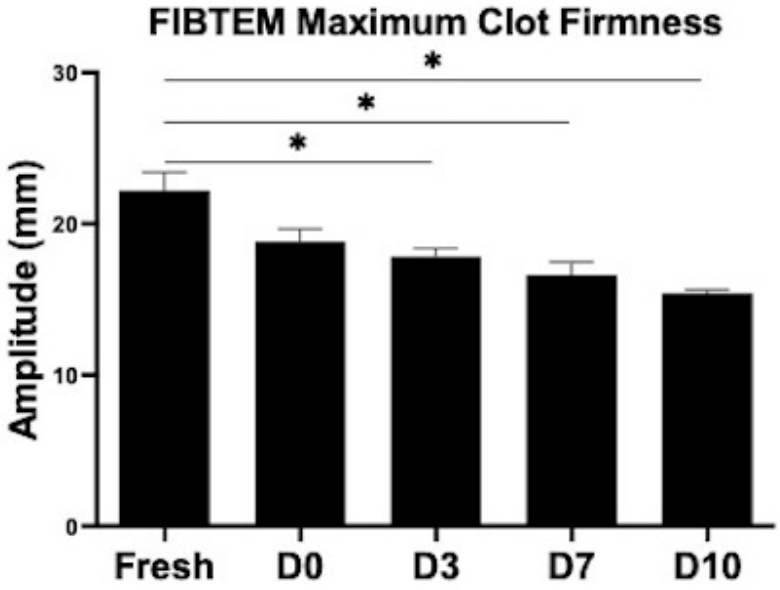


FIGURE 2: FIBTEM MCF for fresh and stored WB. N=5 for all groups. *p<0.05.

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #10
January 10, 2024
11:15 am

A PILOT PROJECT OF A POST DISCHARGE CARE TEAM FOR FIREARM INJURY SURVIVORS IS COST-EFFECTIVE AND DECREASES OUTPATIENT EMERGENCY DEPARTMENT UTILIZATION

Elise Biesboer, MD*, Amber Brandolino, MS, Ashley Servi, DNP, RN, Rebecca Laszkiewicz, RN, Liza Herbst, MSW, Colleen M. Trevino, NP, PhD*, Carissa Tomas, PhD, Terri deRoon-Cassini, PhD
Medical College of Wisconsin

Presenter: Elise Biesboer, MD

Discussant: Robert Winfield, MD – University of Kansas Medical Center

Objectives: Firearm injury survivors are predominantly young, Black males that have unique physical, social, and mental health needs. Consequently, they experience challenges accessing and navigating complex health systems after injury. We developed a Post Discharge Care Team (PDCT) consisting of a trauma nurse navigator and social worker to augment the current care system with the goal of addressing social concerns, increasing health literacy, facilitating a care plan in order to bridging the gap between discharge and outpatient clinic appointments, thereby preventing ED misutilization and readmissions.

Methods: Firearm injury survivors admitted to the trauma service were randomized to either the PDCT or standard of care (SOC). The PDCT nurse provided education regarding injuries, wound care, and outpatient follow up. The PDCT social worker identified social concerns including housing and financial instability, food insecurity and transportation. Primary outcomes were ED utilization, readmissions, and hospital costs. A first quarter analysis compared outcomes between the two groups.

Results: A total of 23 patients were randomized to PDCT and 32 patients to SOC. ED visits were lower in the PDCT group while readmission rates were similar between groups (Table 1). However, the PDCT saved a net $71,857.87 in health care costs. This was most prominent in readmission costs, with an average readmission cost of $30,344.51 in the SOC group compared to $11,452.92 in the PDCT (Table 2).

Conclusions: A collaborative, specialized PDCT for firearm survivors consisting of a nurse navigator and social worker decreased ED utilization and was cost effective. Trauma centers with high volumes of penetrating trauma should consider a similar model to improve outpatient care for firearm injury survivors.

Title: A Pilot Project of a Post Discharge Care Team for Firearm Injury Survivors is Cost-Effective and Decreases Outpatient Emergency Department Utilization

	PDCT	Standard of Care	p-value
n	23	32	
Age*	26 (9)	30 (15)	0.49
Male Gender	19 (83%)	25 (78%)	0.68
Insurance			0.44
Medicaid	19 (83%)	26 (81%)	
Private	4 (17%)	4 (13%)	
Uninsured	0 (0%)	2 (6%)	
Operative Intervention	17 (74%)	22 (69%)	0.68
Hospital LOS*	5 (9)	5 (6)	0.59
ICU Stay	11 (48%)	12 (38%)	0.44
ICU LOS*	3 (7)	4 (5)	0.36
Patients who visited ED	4 (17%)	10 (31%)	0.24
ED visits per Patient			0.18
1	2 (50%)	6 (60%)	
2	2 (50%)	1 (10%)	
3	0 (0%)	3 (30%)	
Patients Readmitted	7 (30%)	6 (19%)	0.31

Table 1: Demographic, hospital characteristic, and outcome comparisons between the PDCT and Standard of Care Groups.
*median, interquartile ratio

	PDCT	Standard of Care
Patients Returned	7	12
Number of ED Visits	5	15
Total ED Visit Cost	$4,673.67	$10,766.91
Average ED Visit Cost	$934.73	$717.79
Number of Readmissions	7	6
Total Readmission Cost	$80,170.43	$182,067.06
Average Readmission Cost	$11,452.92	$30,344.51
Total Cost Difference	**$107,989.87**	
Program Costs	**$36,132**	
Net Return	**$71,857.87**	

Table 2: Cost data comparisons between the PDCT and SOC Groups.

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #11
January 10, 2024
11:30 am

SMOKING PRIMES THE METABOLOMIC RESPONSE IN TRAUMA

Lauren T. Gallagher, MD, Christopher Erickson, PhD, Angelo D'Alessandro, PhD, Kirk Hansen, PhD, Ernest Eugene Moore, MD*, Angela Sauaia, MD, PhD, Otto N. Thielen, MD, TJ Schaid, MD, William Hallas, MD, Sanchayita Mitra, BS, Preston Stafford, MS, Christopher Silliman, MD, PhD, Carolyn Calfee, MD MAS, Mitchell Cohen, MD, FACS*
University of Colorado, Aurora

Presenter: Lauren T. Gallagher, MD

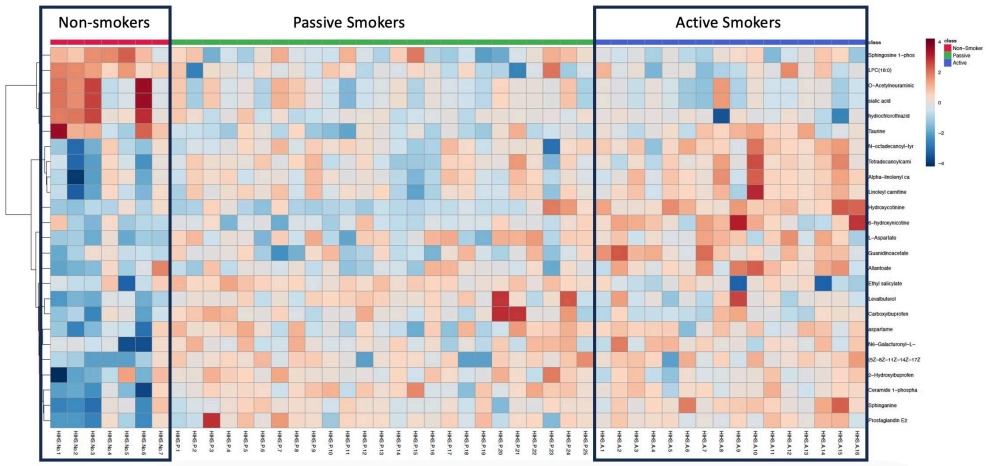
Discussant: Jason W. Smith, MD, PhD, MBA

Objectives: Smoking is a public health threat due to its well described link to increased oxidative stress-related diseases including peripheral vascular disease and coronary artery disease. Tobacco use has been linked to risk of inpatient trauma morbidity including ARDS, however its mechanistic effect on comprehensive biological heterogeneity has yet to be examined.

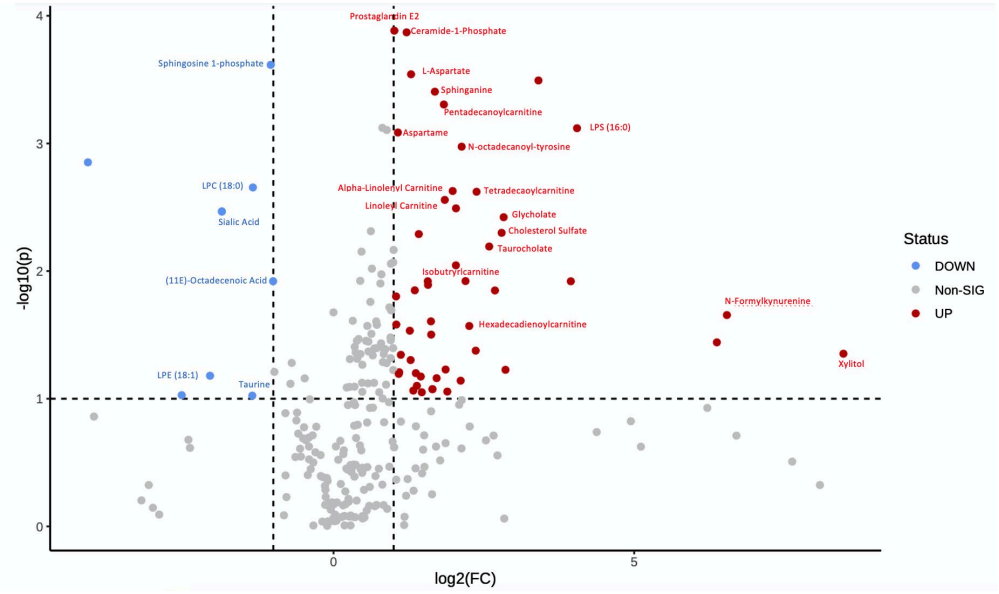
Methods: Plasma was obtained on arrival from injured patients at a Level 1 Trauma Center and analyzed with modern mass spectrometry-based metabolomics. Patients were stratified by non-smoker, passive smoker and active smoker by lower, inter-quartile and upper quartile ranges of cotinine intensity peaks. Patients were sub-stratified by High Injury/High Shock (Injury Severity Score³15, Base Excess<-6). P-value <0.05 following FDR correction of t-test was considered significant.

Results: 48 patients with High Injury/High Shock were included (7 [15%] non-smokers, 25 [52%] passive smokers and 16 [33%] active smokers). We identified subsets of metabolites significantly elevated in non-smokers and active smokers (Figure 1). Elevated metabolites in smokers include enrichment in the malate-aspartate shuttle, tyrosine metabolism, carnitine synthesis, and beta-oxidation of very long-chain fatty acids. Within non-smokers elevated metabolites enrich for taurine and hypotaurine metabolism (Figure 2).

Conclusions: Smoking promotes a state of oxidative stress leading to mitochondrial dysfunction which is additive to the inflammatory mileu of trauma. Smoking is associated with impaired mitochondrial substrate utilization of long-chain fatty acids, aspartate and tyrosine all of which accentuate oxidative stress following injury. This altered expression represents an ideal target for therapies to reduce oxidative damage toward the goal of personalized treatment of trauma patients.



Heatmap for covariate-adjusted metabolomics by cotinine exposure in high injury/high shock patients, displaying analytes significantly different (p-value<0.05) between non-smokers, passive smokers and active smokers.



Adjusted metabolome-wide Spearman correlations with cotinine exposure showing the independent effect of cotinine exposure on metabolite concentration changes. Metabolites are plotted by log (fold change, X-axis) and -log10 transformed P-value for each correlation (Y-axis). Significant up-regulated correlates are labeled in red with significant down-regulated correlates labeled in blue.

Scientific Session II - Raymond H. Alexander, MD Resident Paper Competition

Paper #12
January 10, 2024
11:45 am

DON'T LEAVE OUT THE LADIES: THE SAFETY PROFILE OF EMPIRIC TRANSFUSION OF WHOLE BLOOD AT A SINGLE INSTITUTION

Courtney H. Meyer, MD, MPH, Humphrey Pruett, Randi Smith, MD, MPH*, Jason D. Sciarretta, MD, FACS*, James Sikora, MD, April A. Grant, MD, FACS*, Jonathan Nguyen, DO*
Emory University School of Medicine

Presenter: Courtney H. Meyer, MD, MPH

Discussant: Jeremy Cannon, MD, SM – University of Pennsylvania

Objectives: Emerging evidence suggests transfusion of whole blood (WB) may be a safe and effective alternative to component-based therapy (CBT) for resuscitation in trauma. WB has historically been used in the military setting, and early studies in the civilian setting have shown potential survival benefits when comparing cold stored low titer O Rh-D+ whole blood (LTOWB) to CBT, alone. However, the potential for isoimmunization in females of child bearing potential (FCP) remains a critical concern. Given the current paucity of evidence regarding this risk, we investigated the incidence of isoimmunization and antibody formation in females receiving LTWOB.

Methods: A retrospective review was conducted at a trauma center, from Jan 2021-Dec 2022. All female patients who received emergent LTOWB were included. FCP were defined as 15-49 years per the World Health Organization definition. The primary outcome of interest was the presence of antibodies on subsequent screens.

Results: 93 female patients met inclusion criteria and were predominantly black (68.1%) with a median age of 51. 46.2% were FCP, and their median age was 29. The overall mortality rate was 40% and 86% received LTOWB during a massive transfusion protocol activation. The most common indication for transfusion was trauma (70.0%) Patients received a median of 4 units of LTOWB. On subsequent antibody screen within one month after LTOWB transfusion, no patient had positive antibodies.

Conclusions: This study demonstrates that empiric transfusion of LTOWB poses a very low risk of isoimmunization among females. In the context of implementing WB transfusion programs at trauma centers across the US, this suggest that FCPs should be considered in this treatment paradigm. Further research is needed to investigate these trends over time and quantify the risk in order to develop evidence based algorithms for subsequent Rh immune globulin administration.

Table 1: Overall cohort demographics of female patients receiving empiric low titer O Rh-D+ whole blood transfusion for emergent indications

	Patients (n = 93)
Age (median, IQR)	51 [30 – 68]
Age for FCP (median, IQR)	29 [25-35]
% FCP	46.2% (n=43)
Race	
Black	64 (68.1%)
White	15 (15.8%)
Asian or Pacific Islander	3 (3.2%)
Other	5 (5.3%)
Unknown	7 (15.8%)
Ethnicity	
Hispanic or Latino	6 (6.3%)
Not Hispanic or Latino	83 (87.4%)
Unknown	6 (6.3%)
Indication for Transfusion	
Trauma	65 (70.0%)
GI Bleed	11 (11.8%)
OBGYN	8 (8.6%)
Undifferentiated Shock	7 (7.5%)
CT Surgery	2 (2.2%)
Total Blood Products (Mean, Median)	
Whole Blood	3.15, 4 [2-4]
pRBC	9.2, 4 [3-12]
FFP	7.4, 3 [1-10]
Platelets	1.6, 1 [0-2]
Cryo	0.9, 0 [0-1]
Antibodies	
Negative	92 (97.8%)
Positive	0 (0.0%)
N/A*	2 (2.2%)
MTP Activation	
Yes	80 (86%)
Mortality	
Deceased	38 (40%)

Legend: Cryo: cryoprecipitate, **CT surgery**: cardiothoracic surgery, **FCP:** females of child bearing potential, **FFP**: fresh frozen plasma **GI Bleed**: gastrointestinal bleed, **MTP**: massive transfusion protocol, **N/A**: not applicable, **OBGYN**: obstetrics and gynecology, **pRBC**: packed red blood cells

*Denotes female patients who had positive antibody screen charted prior to empiric transfusion of LTOWB and therefore unable to classify as true positive or negative result as sequala of transfusion

Overall cohort demographics of female patients receiving empiric low titer O Rh-D+ whole blood transfusion for emergent indications

Scientific Session III - Cox Templeton Injury Prevention Paper Competition

Paper #13
January 11, 2024
11:15 am

FROM PERIL TO PROTECTION: UNVEILING A ROADMAP TO SAFE ESCOOTER RIDING

Kendra Black, BS, MA, MD*, Jarrett Santorelli, MD*, Leslie Kobayashi, MD, Todd Costantini, MD, Laura N. Haines (Godat), MD, FACS *
University of California San Diego

Presenter: Kendra Black, BS, MA, MD

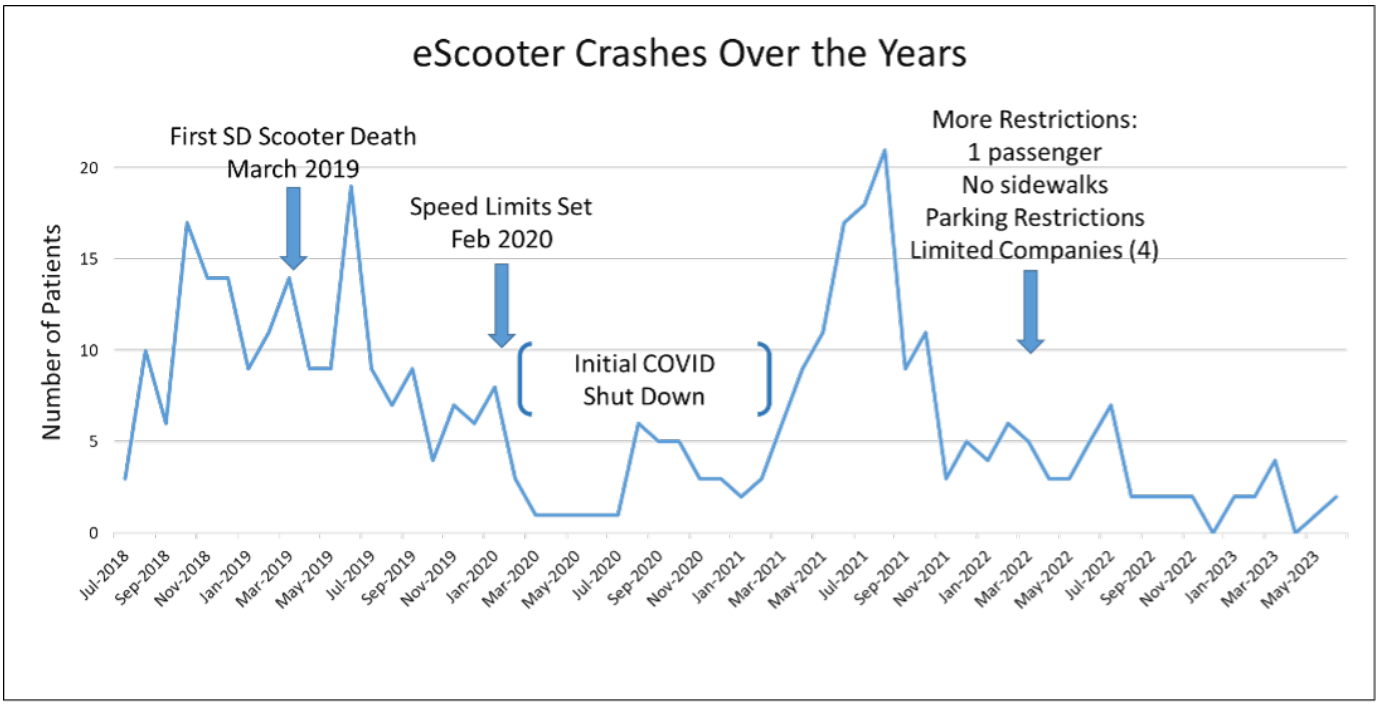
Discussant: Marissa Boeck, MD, MPH – University of California San Francisco

Objectives: Standing electric motorized scooter (eScooter) use has skyrocketed since being first released in 2016. This quickly popularized form of transportation, has been associated with significant injury and even death. These eScooter-related traumatic injuries led to local advocacy efforts, resulting in safety restrictions including speed limit geofencing, sidewalk restrictions, and limiting the number of eScooter providers in high-density population areas. We hypothesized that these local safety restrictions decreased the number of eScooter related injuries presenting to our Trauma Center.

Methods: This is a retrospective cohort study of eScooter accidents presenting to our Level 1 Trauma Center from July 2018 - June 2023. Variables included patient demographics, ISS and mortality. The primary outcome was rate of eScooter incidents in relation to the implementation of loco-regional safety regulations.

Results: A total of 382 patients presented after eScooter crashes. Males were 74.1% of patients. The average age was 38.6 years; 45+ years was the most common age group at 33.0% followed by ages 25-34 (30.9%). The mean ISS was 9.2±5.6; with ISS 0-9 64.4%, ISS 10-15 24.3%, ISS 16-24 8.4% and ISS >25 2.1%. There were 3 (0.8%) deaths. The mean number of injuries per month pre-speed limits was 9.7 & post 6.2 (p=0.013) showing a 36.2% decrease in injuries. Post February 2022 restrictions the rate precipitously declined with a mean of 2.8/month (p=0.005) and an additional 54.3% decrease in rate of injuries (see Figure).

Conclusions: Local advocacy resulting in increased safety regulations was associated with a significant reduction in injuries secondary to eScooter use. This demonstrates the importance of advocacy efforts in response to changes in injury patterns and mechanisms of injury. We believe that our work can serve as a model for other urban centers seeking to reduce eScooter related injuries and implement effective safety measures.



Monthly injury rates with associated timeline of restrictions.

Scientific Session III - Cox Templeton Injury Prevention Paper Competition

Paper #14
January 11, 2024
11:30 am

BULLET HOLES: A NOVEL MODEL TO IDENTIFY THE MOST IMPACTFUL GAPS IN THE FIREARM HOMICIDE PREVENTION LAWS OF EACH STATE

Aksel Laudon, BS, Elizabeth Davis, Xuewei Xiao, Kelly Kenzik, PhD, MS, Sing Chau Ng, MS, Crisanto Torres, MD*, Sabrina Sanchez, MD, MPH*, Tejal S. Brahmbhatt, MD*, Dane R. Scantling, DO, MPH*
Boston University School of Medicine

Presenter: Aksel Laudon, BS

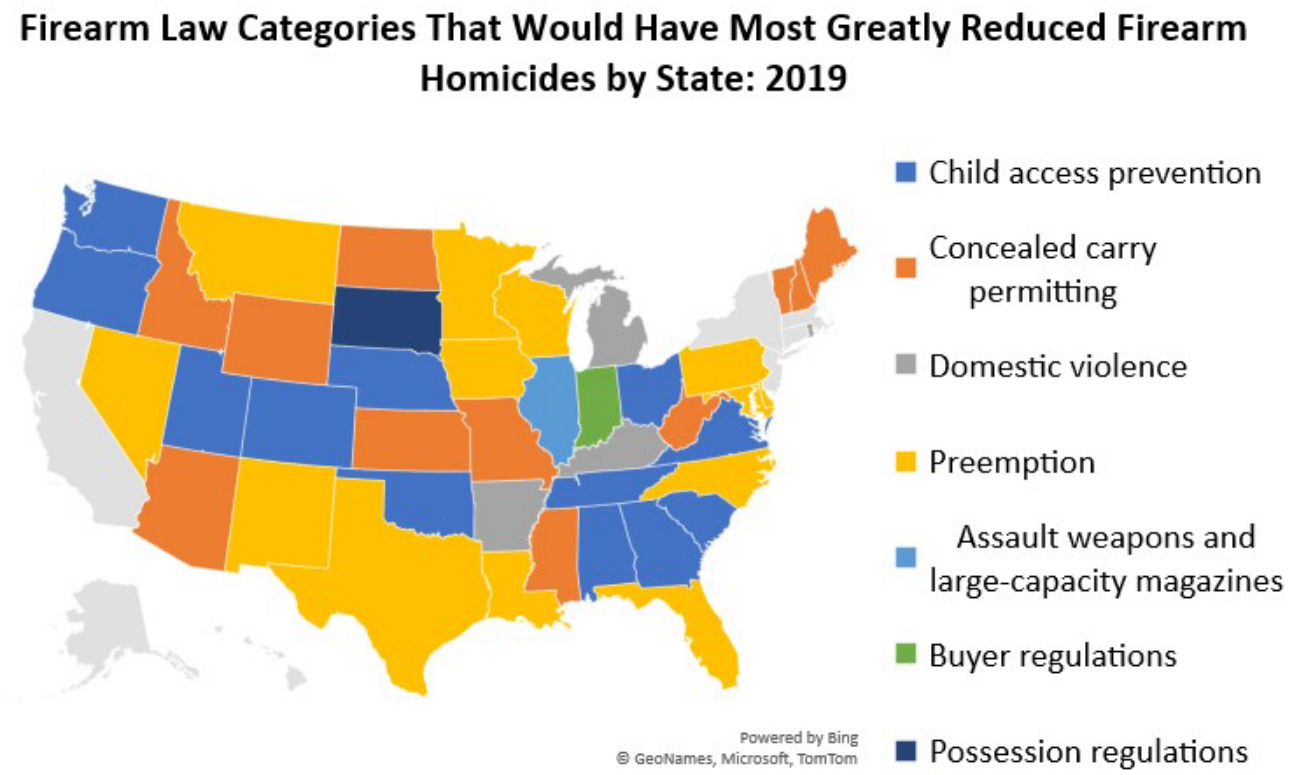
Discussant: Elinore Kaufman, MD, MSHP – University of Pennsylvania

Objectives: The associations between state-level firearm laws and firearm homicides (FH) have been thoroughly evaluated. However, no generalized model exists that accounts for state socioeconomic, population, and legislative factors to guide policymaking in each state. This study sought to develop a model to determine which firearm laws would prevent the most FH overall and in each state if enacted.

Methods: We conducted a retrospective cohort study examining the effects of firearm laws on FH rates in the 48 contiguous US states from 2010-2019. Firearm mortality and firearm law data were obtained from the CDC WONDER database and State Firearm Law Database, respectively. Firearm laws were grouped into 14 law categories, and Poisson regression models for each category were constructed to estimate the incidence rate ratio (IRR) of FH for states with each law compared to those without the law. Models allowed for a random intercept for each state and included state population characteristics and spatial weights to account for spatial autocorrelation.

Results: The mean homicide rate 2010-2019 was 3.58 per 100,000. Only 3 of the 14 law categories were not significantly associated with FH: immunity, prohibitions on high-risk gun possession, and stand your ground (all $p>0.05$). In our last year of analysis 2019, the most effective law categories were preemption (27.1% of states, median FH prevented 2.6 per 100,000), child access prevention (25.0%, 3.3 per 100,000), and concealed carry permitting (22.9%, 1.0 per 100,000). 14.6% of states had all 14 law categories in 2019.

Conclusions: Modeling firearm law prevention of FH with regard to state characteristics can identify highest impact missing law categories. These results can be used to inform legislative priorities aimed at reducing rates of FH in the US.



Depiction of the most impactful law categories to prevent firearm homicides had they been enacted in 2019.

Scientific Session III - Cox Templeton Injury Prevention Paper Competition

Paper #15
January 11, 2024
11:45 am

ENGAGING YOUNG BLACK MEN WHO HAVE BEEN VICTIMS OF GUN VIOLENCE IN MENTAL HEALTH SERVICES

Melike N. Harfouche, MD*, Erin Major, B.S, Celina Thomas, B.S., Charlotte Healy, MD, Amy VanderStoep, M.D, Joseph Richardson, Ph.D, Thomas M. Scalea, MD, FACS, FCCM*,
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Presenter: Melike N. Harfouche, MD

Discussant: Randi Smith, MD, MPH – Emory University School of Medicine

Objectives: Young, Black men experience the highest rates of gun violence and are at greatest risk for repeat injury. The aim of this study was to identify barriers to participation in mental health services for this population.

Methods: One hour-long focus group was held with counselors of the local hospital-based violence intervention program and 21 individual interviews were held with Black men who were hospitalized for gun violence over a 2-year period. All interviews were recorded and transcribed. Transcripts were coded using grounded theory methodology and ultimately grouped into themes using MAXQDA 2022 software.

Results: Median age of participants was 34 (IQR=11). A total of 1377 individual codes were generated. Barriers to participation revolved around competing priorities/stressors, expense, difficulty with trust and openness, and the demands of street life. Motivating factors included cultural competence, persistence, availability, reliability, and genuineness of the therapy staff. Most participants denied negative stigma as a barrier but emphasized that the individual must value therapy to participate. Young, Black men were identified as struggling with self and peer-imposed behavioral expectations that conflicted with therapy participation.

Conclusions: Young, Black men who have experienced gun violence face strong environmental pressures that conflict with participation in mental health services. Programs must be integrated with other social services and be responsive to community conditions to be successful.

Scientific Session III - Cox Templeton Injury Prevention Paper Competition

Paper #16
January 11, 2024
12:00 pm

STRENGTHS OF WOMEN WORKING IN VIOLENCE INTERVENTION AND OUTREACH: PROVIDING SPACE FOR EMOTIONAL VULNERABILITY AND EMPATHY

Grace Keegan, Chanel Jones, Collette Foster, BS, Paige-Ashley Campbell, MD,
Tanya L. Zakrison, MD, MPH, FRCSC, FACS*, Lea Hoefer, MD
University of Chicago

Presenter: Grace Keegan

Discussant: Alexis Nickols, MD - University of Kentucky

Objectives: There exists a significant knowledge gap surrounding the unique strengths and challenges that female violence intervention specialists may have when working with at-risk young men. The purpose of this study was to characterize the intersections of gender and violence intervention for women working with survivors of interpersonal violence.

Methods: We conducted a qualitative study of women working in violence intervention via focus groups. Perceived strengths and risks were explored using a semi-structured interviewing technique. Focus groups were transcribed and coded by 2 separate evaluators; grounded theory methodology was used for thematic analysis.

Results: 17 violence intervention and outreach specialists who identify as women were included in 3 focus groups, most of whom identify as women of color. Common challenges include a sense of powerlessness when faced with inequitable structural limitations and secondary traumatization from work with people affected by violence. When discussing the role of their gender identity in the work, the women reported that men seem more willing to be emotionally vulnerable with women, including disclosures of history of sexual abuse. Women also experience a lack of respect personally and professionally in their role related to gender, at times even facing violence from clients themselves. The women revealed a need for leadership opportunities to leverage their strengths and for enhanced training, especially for male colleagues who may benefit from the insights of colleagues who are women.

Conclusions: Women bring unique strengths to roles as violence intervention specialists to deal with trauma and prevent future violence. These findings suggest a need for specific curricula to support women working in violence intervention and further studies which explore the intersectional role of race as well as gender in violence intervention work.

Scientific Session IV

Paper #17
January 11, 2024
1:40 pm

THORACIC CAVITY IRRIGATION PREVENTS RETAINED HEMOTHORAX AND DECREASES SURGICAL INTERVENTION IN TRAUMA PATIENTS

Abdul Hafiz Al Tannir, MD, Elise Biesboer, MD*, Morgan Tentis, BS, Morgan Maring, Jacob Peschman, MD*, Patrick B Murphy, MD, MPH, MSc*, Rachel S. Morris, MD, FACS*, Marc A. de Moya, MD*, Thomas Carver, MD, FACS
Medical College of Wisconsin

Presenter: Abdul Hafiz Al Tannir, MD

Discussant: Cynthia Talley, MD – Medical University of South Carolina

Objectives: Retained hemothorax (HTX) is a common complication following thoracic trauma. In 2015, our trauma division established the use of thoracic cavity irrigation for the prevention of retained HTX. Accordingly, we sought to assess the effectiveness of chest irrigation in preventing retained HTX and decreasing the need for surgical intervention. We hypothesized that chest irrigation prevents retained HTX and decreases the need for surgical intervention.

Methods: We conducted a single-center retrospective study 2017-2021 at a level I trauma center comparing thoracic cavity irrigation versus no irrigation. Patients with traumatic HTX were identified through the trauma registry. Exclusion criteria were tube thoracostomy (TT) placement at an outside hospital, TT placed >24 hours after injury, thoracotomy or video-assisted thoracoscopic surgery (VATS) within 6 hours of TT placement, VATS for diaphragmatic repair, planned rib fixation, and death within 7 days of admission.

Results: A total of 370 patients met the inclusion criteria, of whom 225 (61%) were irrigated. Patients who were irrigated were more likely to suffer a penetrating injury (42% vs 30%,p=0.03) and less likely to have a flail chest (10% vs 21%,p=0.01) (Table1). On univariate analysis, irrigation was associated with lower rates of VATS (6% vs 19%,p<0.001) and retained HTX (10% vs 21%,p=0.01) (Figure1). The irrigated cohort had a shorter TT duration (4 vs 6 days,p<0.001) and hospital length of stay (8 vs 10 days,p=0.04). On multivariate analysis, thoracic irrigation had lower odds of VATS (AOR: 0.35, p=0.001) and retained HTX (AOR: 0.42,p=0.01). Additionally, it was associated with a shorter TT duration (Beta: -3.3,p=0.01).

Conclusions: Our 5-year experience with thoracic irrigation has confirmed findings from smaller studies that irrigation at the time of TT placement prevents retained HTX and decreases the need for surgical intervention.

Variable	Irrigation N=225	No Irrigation N=145	p-value
Age, median (IQR)	39 (28-46)	44 (30-52)	0.24
Male, n (%)	177 (79)	113 (78)	0.87
White, n (%)	106 (47)	76 (52)	0.38
Penetrating injury, n (%)	93 (42)	44 (30)	0.03
ED SBP, median (IQR)	125 (105-134)	129 (108-138)	0.91
GCS, median (IQR)	15 (13-15)	515 (13-15)	0.88
ISS, median (IQR)	17 (12-26)	18 (14-26)	0.39
Bilateral HTX, n (%)	25 (11.2)	19 (13.5)	0.51
Flail Chest, n (%)	23 (10)	29 (21)	0.006
Pulmonary Contusion, n (%)	143 (64)	88 (62)	0.78
Diaphragmatic Injury, n (%)	25 (11)	16 (11)	0.96
Concurrent PTX, n (%)	185 (83)	120 (85)	0.53
Abdominal injury, n (%)	66 (30)	49 (35)	0.29

SBP: systolic blood pressure, GCS: Glasgow coma scale, ISS: injury severity score, HTX: hemothorax, PTX: pneumothorax, IQR: interquartile range

Table 1: Comparison of baseline and admission characteristics across both cohorts.

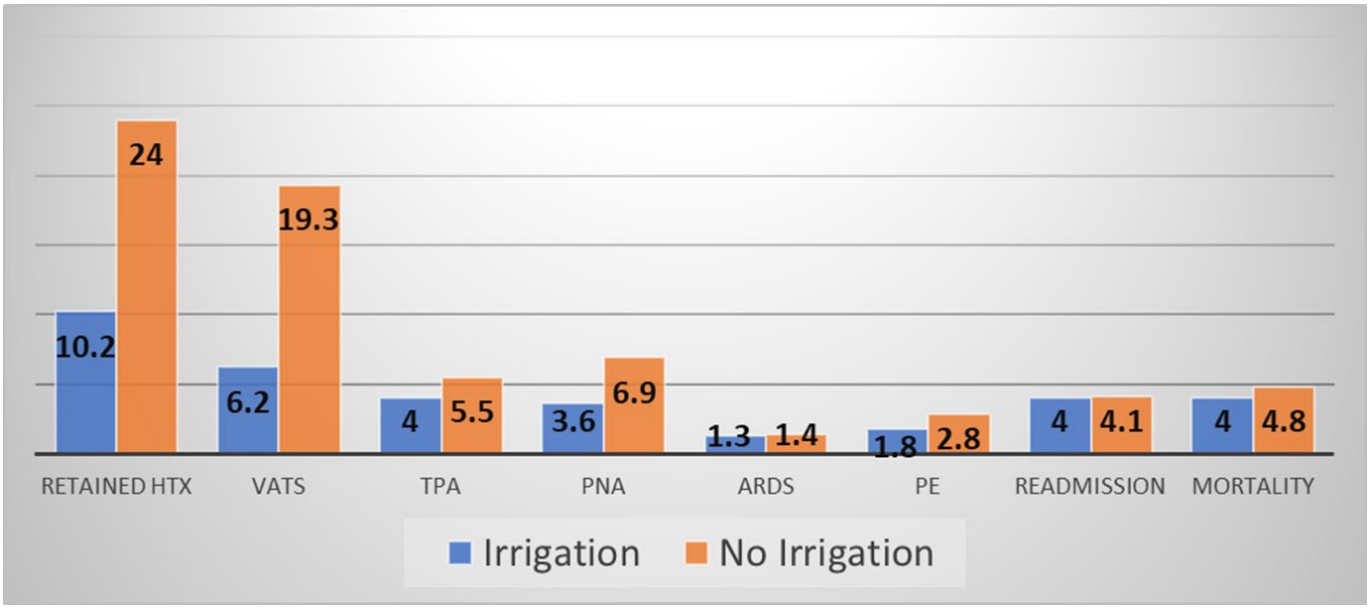


Figure 1: Comparison of complications and hospital outcomes across both cohorts

Scientific Session IV

Paper #18
January 11, 2024
1:55 pm

STANDARD ROTEM PROTOCOLS MAY FAIL TO IDENTIFY COAGULOPATHY IN HYPOTHERMIC TRAUMA PATIENTS

Maraya Camazine, MD*, Hudson M Surber, B.A., B.S., Scott Stewart, MS, Nolan UAMS, MD, Avi Bhavaraju, MD*, Kyle Kalkwarf, MD, Joseph Margolick, MD, FRCSC*
University of Arkansas for Medical Sciences

Presenter: Maraya Camazine, MD

Discussant: Grace Niziolek, MD – Washington University School of Medicine

Objectives: Hypothermia causes dysregulation of the coagulation cascade, which is often amplified in trauma patients experiencing major blood loss. Rotational thromboelastometry (ROTEM) is commonly used to measure coagulopathy; however, samples are warmed to 37 degrees Celsius during analysis. We aim to compare ROTEM samples at standard protocol (37C) to hypothermic protocol (patient's native temperature at time of collection).

Methods: Prospective, single-center study in hypothermic (core temperature <35C) trauma patients. Paired ROTEM samples were obtained and analyzed using standard and hypothermic protocol. Wilcoxon tests were used to compare samples.

Results: Twenty-four paired ROTEMs from 12 patients were analyzed. Median age was 48 (38-59), and 50% were male. The average temperature of hypothermic ROTEM assay was 34.2C. Clot Formation Times (CFT) were prolonged within the hypothermic assay by an average of 45.4 seconds (EXTEM) and 51.3 seconds (INTEM), $p<0.01$ for both (Figure 1). Maximum Clot Firmness (MCF) was decreased by an average 3.0 mm (EXTEM, $p=0.01$) and 3.3 mm (INTEM, $p<0.01$). EXTEM and INTEM A10 and A20 values additionally showed decreased amplitude using the hypothermic protocol (all $p<0.01$). Using local ROTEM-directed transfusion guidelines, 25% of patients who did not meet platelet transfusion criteria based on standard protocol results, met transfusion criteria based on hypothermic protocol results.

Conclusions: ROTEM results differed between protocols, with abnormal platelet function parameters more frequently seen using the hypothermic protocol. These data indicate that ROTEMs conducted at a native hypothermic temperature may better guide coagulopathy correction compared to standard warm assay protocols. More extensive studies are needed to validate temperature thresholds to perform hypothermic ROTEM assays and how hypothermic ROTEM-directed resuscitation impacts blood product utilization and outcomes.

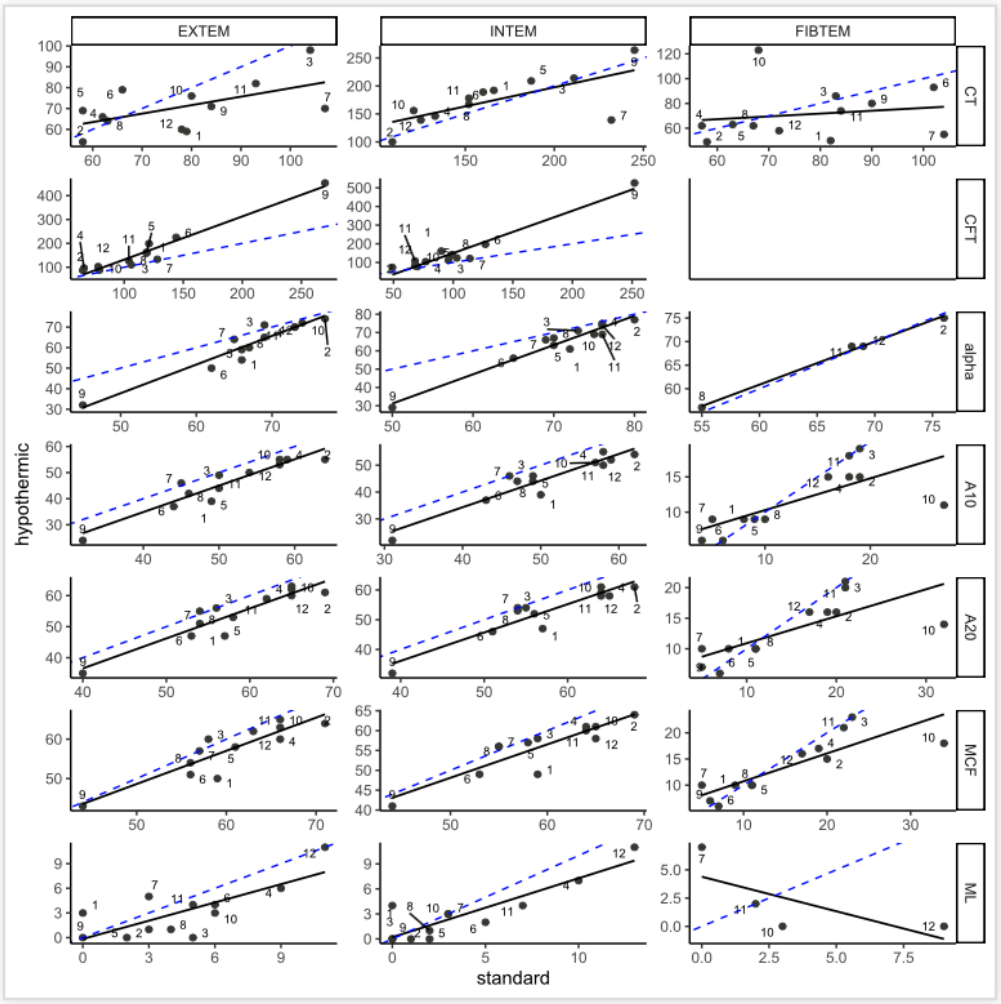


Figure 1: ***Standard vs Hypothermic Measures****. Blue dashed line represents line of identity.*

Figure 1: Standard vs Hypothermic Measures. *Blue dashed line represents line of identity.*

Scientific Session IV

Paper #19
January 11, 2024
2:10 pm

DIMETHYL SULFOXIDE AS A NOVEL THERAPY IN A MURINE MODEL OF ACUTE RESPIRATORY DISTRESS SYNDROME

Sharven Taghavi, MD, MPH, MS, FACS*, David Engelhardt, Alexandra Campbell, BS,
Juan C. Duchesne, MD, FACS, FCCP, FCCM*, Farhana Shaheen, BS, Derek Pociask, PhD,
Jay Kolls, MD, PHD, Olan Jackson-Weaver, PhD
Tulane University School of Medicine

Presenter: Sharven Taghavi, MD, MPH, MS, FACS

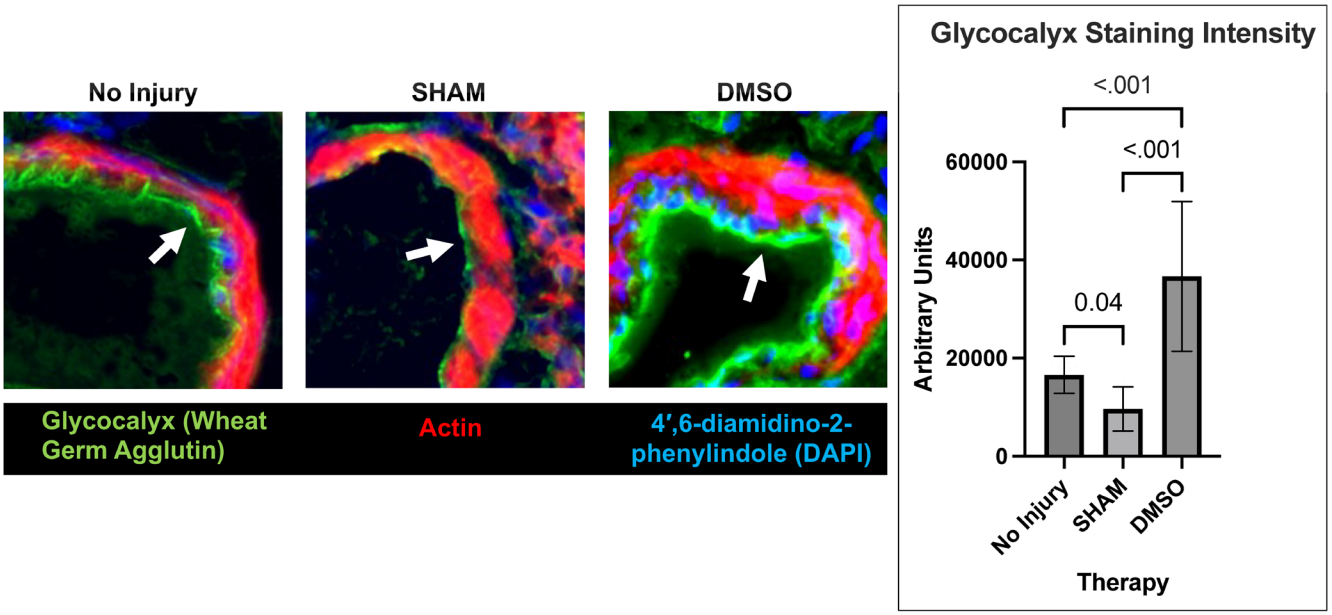
Discussant: John Agapian, MD – University of California, Riverside

Objectives: The endothelial glycocalyx (EGX) on the luminal surface of endothelial cells contributes to the permeability barrier of the pulmonary vasculature. Dimethyl sulfoxide (DMSO) has a disordering effect on plasma membranes, which prevents the formation of ordered membrane domains that are integral to shedding of the EGX. We hypothesized that DMSO would protect against protein leak by preserving the EGX in a murine model of acute respiratory distress syndrome (ARDS).

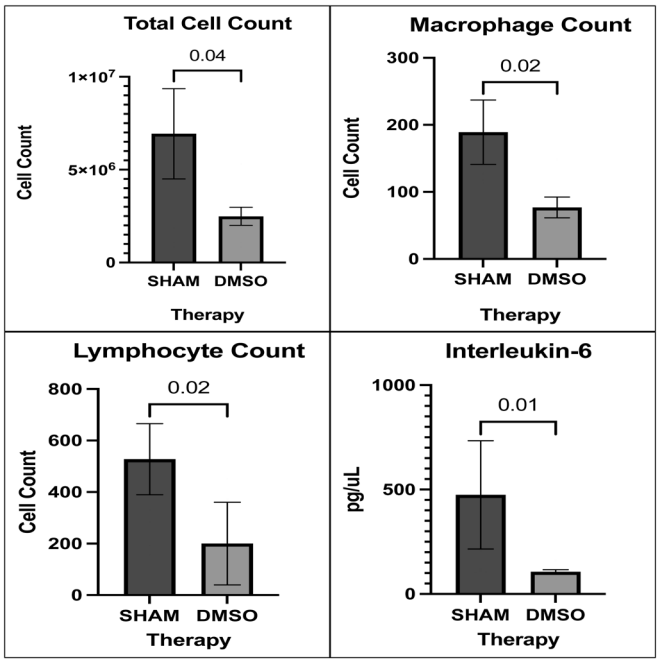
Methods: C57BL/6 mice were given ARDS via 67.7 ug of intra-tracheally administered lipopolysaccharide. DMSO (220 mg/kg) was administered via tail vein injection 30 minutes after injury then daily for 3 days. Animals were sacrificed post-injury day 4 after bronchoalveolar lavage (BAL). BAL cell counts were performed to examine cell influx. BAL protein was quantified via Bradford protein assay. Animals receiving DMSO (n=8) were compared to those receiving sham injections (n=8) using Student's t-test. Cells were fixed and stained with FITC-labelled wheat germ agglutinin to quantify the EGX.

Results: Treatment with DMSO resulted in greater EGX staining intensity in the lung (Fig 1) when compared to sham (9,641 vs. 36,659 Arbitrary Units; $p<0.001$). Total BAL cell counts were less for animals receiving DMSO (6.93×10^6 vs. 2.49×10^6cells, $p=0.04$). The treated group had less BAL macrophages (189.2 vs. 76.9 cells, $p=0.02$) and lymphocytes (527.7 vs. 200.0 cells, $p=0.02$). Neutrophils were absent. Interleukin-6 levels were lower in DMSO treated (Fig 2). BAL interferon-gand tumor necrosis factor-a were not different. Animals that received DMSO had less protein leak in BAL (1.48 vs. 1.08 ug/ul, $p=0.02$). There was no difference in degree of weight loss in treated animals (3.7% vs. 3.1%, $p=0.41$).

Conclusions: Systemically administered DMSO protects the EGX in the pulmonary vasculature, mitigating pulmonary capillary leak after acute lung injury. DMSO also results in decreased inflammatory response. DMSO may be a novel therapeutic for ARDS.



Systemic administration of dimethyl sulfoxide (DMSO) results in increased staining intensity of the endothelial glycocalyx when compared to sham animals or animals without any injury. Representative images are also shown.



Treatment with dimethyl sulfoxide (DMSO) results in decreased bronchoalveolar lavage total cell count, macrophage count, lymphocyte count, and Interleukin-6.

Scientific Session IV

Paper #20
January 11, 2024
2:25 pm

ACUTE EMERGENCE OF THE PATHOBIOME AFTER POSTINJURY PNEUMONIA

Jennifer A Munley, MD, Lauren S. Kelly, MD*, Gwoncheol Park, MS, Stacey Kirkpatrick, MD*, Gwendolyn Gillies, MD, Preston Coldwell, BS, Kolenkode Kannan, PhD, Letitia Bible, MD*, Philip Efron, MD*, Ravinder Nagpal, PhD, Alicia M. Mohr, MD, FACS, FCCM*
University of Florida

Presenter: Jennifer A Munley, MD

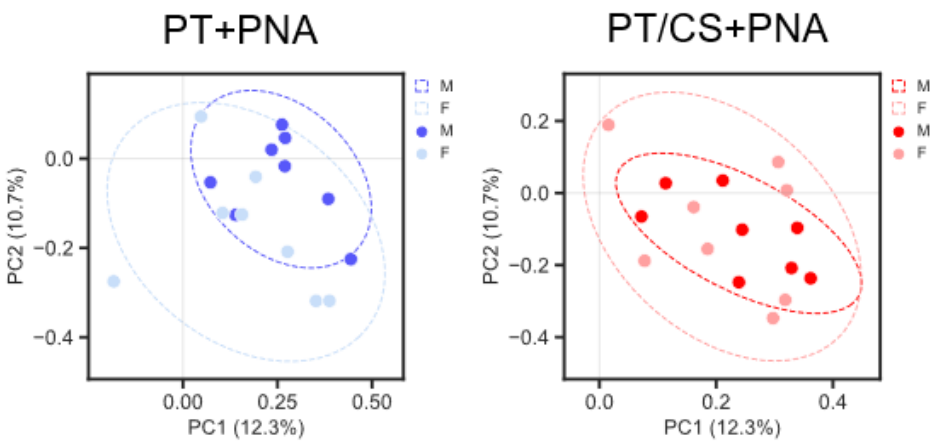
Discussant: Timothy Plackett, DO, MPH – University of Chicago

Objectives: Previous preclinical studies have demonstrated sex-specific alterations in the gut microbiome following traumatic injury or sepsis alone; however, the impact of host sex on dysbiosis in the setting of postinjury sepsis acutely is unknown. We hypothesized that multicompartmental injuries with subsequent pneumonia would result in host sex-specific dysbiosis.

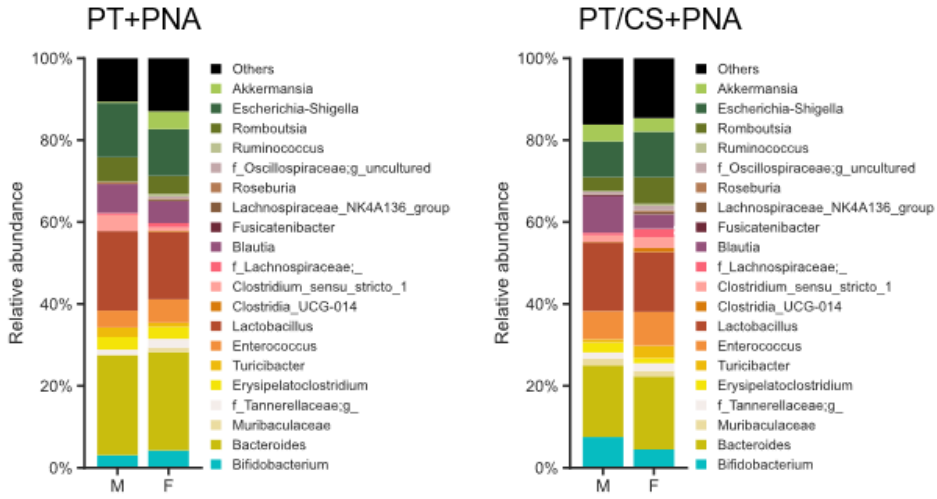
Methods: Male and proestrus female Sprague-Dawley rats (n=8/group) were subjected to either polytrauma (PT) (lung contusion, hemorrhagic shock, cecectomy, bifemoral pseudofracture), PT plus 2-hours daily chronic restraint stress (PT/CS) PT with postinjury day 1 *pseudomonas aeruginosa* pneumonia (PT+PNA), PT/CS with pneumonia (PT/CS+PNA) or naive controls. Fecal microbiome was measured on days 0 and 2 using high-throughput 16S rRNA sequencing and QIIME2 bioinformatics analyses. Microbial a diversity was assessed using Chao1 (number of different unique species) and Shannon (species richness and evenness) indices. Î²-diversity was assessed using principal coordinate analysis. Significance was defined as $p<0.05$.

Results: All groups had drastic declines in Chao1 and Shannon indices compared to controls ($p<0.05$). PT+PNA and PT/CS+PNA resulted in different Î²-diversity compared to uninfected counterparts (PT, PT/CS) ($p=0.001$) (Fig. 1). At day 2, PT+PNA resulted in Î²-diversity which was unique between males and females ($p=0.004$) (Fig. 1). Microbial composition in PT+PNA males was dominated by *Anaerostipes* and *Parabacteroides* whereas females had increased *Barnesiella* and *Oscillibacter* (Fig. 2). PT/CS males had an abundance of *Gastranaerophilales* and *Muribaculaceae* (Fig. 2).

Conclusions: Multicompartmental trauma complicated by sepsis significantly diminishes microbiome diversity and alters microbial composition to a pathobiome early after injury, which vary by host sex. These findings suggest that sex is an important biological variable that may influence outcomes after severe trauma and sepsis.



Principal coordinate analysis (PCoA) plots showing changes in beta-diversity, the measure of differences in biodiversity, between males (M) and females (F) at day two in the PT+PNA or PT/CS+PNA groups. PT+PNAâ€“ polytrauma with pneumonia; PT/CS+PNA â€“ polytrauma with chronic stress with pneumonia.



Microbial composition of male (M) and female (F) rats by cohort (PT+PNA) polytrauma with pneumonia, and PT/CS+PNA polytrauma with chronic stress with pneumonia) at day 2.

Scientific Session IV

Paper #21
January 11, 2024
2:40 pm

LUNG ULTRASOUND UNDERDIAGNOSES CLINICALLY SIGNIFICANT PNEUMOTHORAX

Jarrett Santorelli, MD*, Laura Adams, MD*, Louis A Perkins, MD, Lisa Kurth, MD*,
William A Marshall, MD, Jay Doucet, MD MSc*, Todd Costantini, MD
University of California San Diego

Presenter: Jarrett Santorelli, MD

Discussant: Rachel Appelbaum, MD – Vanderbilt University Medical Center

Objectives: Ultrasonography for trauma is an integral part of the Advanced Trauma Life Support algorithm and supported extensively in the literature. The reliability of chest ultrasound (CUS) as a screening exam for pneumothorax during initial trauma evaluation is unclear. We have previously demonstrated in a retrospective study that CUS was associated with a high rate of false negative exams. Here, we performed a prospective study where we hypothesized that CUS would have low sensitivity for detecting clinically significant pneumothorax.

Methods: A prospective observational analysis of patients with blunt chest trauma at a Level 1 trauma center was performed. Patients included had routine supine CXR and CUS performed prior to intervention as well as confirmatory CT imaging. All CUS were performed in the trauma bay by a registered sonographer using a linear probe on lung settings. All imaging was evaluated by an attending trauma surgeon and radiologist in real time.

Results: Of the 2185 patients screened with a diagnosis of blunt thoracic trauma, 1499 patients had CXR, CUS and confirmatory CT and were included for analysis. Patients were 71% male, with mean age of 46, and mean chest AIS of. The sensitivity of CUS to detect pneumothorax was low (see table) CUS had a FN rate of 67% (n=61) with 25% (n=15) undergoing tube thoracostomy. Patients with FN exams had lower initial O2 sats, and systolic BP, and were more likely to have rib fractures compared to true negative CUS exams.

Conclusions: CUS performed on initial trauma evaluation has low sensitivity with a high rate of false negative exams. Since many of these false negative results are clinically significant requiring thoracostomy, using CUS alone to screen for pneumothorax should be done with caution.

	Sensitivity	Specificity	PPV	False Negative (FN)
CUS	32%	99%	80%	68%
CXR	49%	99%	98%	51%

Scientific Session IV

Paper #22
January 11, 2024
2:55 pm

DOES THE 35MM RULE APPLY IN CHEST X-RAYS? A SINGLE-INSTITUTION VALIDATION STUDY

Shruthi Srinivas, MD, Katelyn Henderson, BS, Ayanna Jacobs, MD, Holly Baselice, MPH,
Edwin Donnelly, MD, PhD, Carrie Valdez, MD*, Julia R. Coleman, MD, MPH*
The Ohio State University

Presenter: Shruthi Srinivas, MD

Discussant: Rishi Rattan, MD – Legacy Emanuel Medical Center

Objectives: Pneumothorax (PTX) occurs frequently in trauma patients and requires surgical decision to intervene with tube thoracostomy (TT) or observe. The “35-mm” rule advocates observation in patients with a PTX less than 35 mm on chest tomography (CT) scan, however this has not been examined in chest x-rays (CXRs). The aim of this study is to validate the 35-mm rule in CXRs and determine correlation between CXR and CT PTX size.

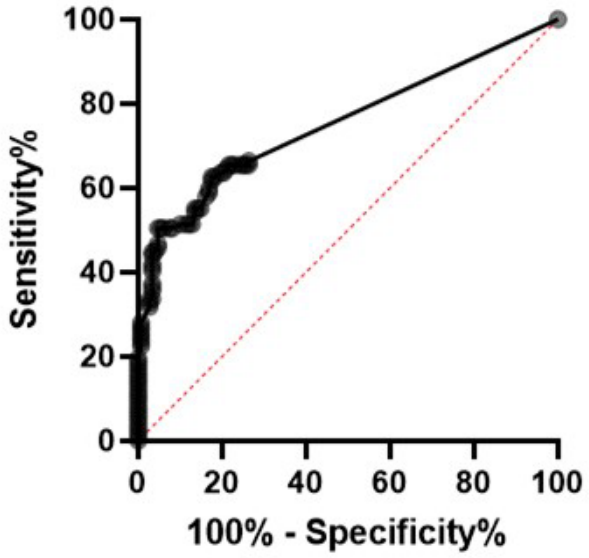
Methods: We performed a single-institution retrospective review of patients with traumatic PTX from 2018- 2022, excluding those who underwent TT prior to initial radiograph. Primary outcome was failed observation, defined as need for delayed TT after trauma resuscitation. Patients were grouped by occult PTX (not visible on CXR, visible on CT) versus non-occult PTX on CXR. To determine the optimal PTX size cutoff predictive of TT need on CXR, area under the receiver operating curve (AUROC) analyses were performed and J-statistics were calculated. P-values of < 0.05 were considered significant.

Results: There were 358 pneumothoraces in 328 patients (71% blunt trauma, 94% male, median injury severity score 14.0). There were 161 PTX that were non-occult, with a median size of 8.6 mm on CXR and 14.1 mm on CT. CXR size correlated moderately well with CT size ($r = 0.31$, $p<0.001$). Those with non-occult PTX underwent more TT placement (64.6% vs 29.0%, $p<0.001$), though more patients with occult PTX failed observation (50.0% vs 26.0%, $p<0.001$). The PTX size on CXR was highly predictive of TT insertion (AUC 0.75, $p<0.0001$), with an optimal largest size cutoff on CXR to predict TT placement of 38 mm.

Conclusions: CXR imaging size correlated with CT imaging size and was predictive of need for TT. The optimal size cutoff to predict TT need on CXR was 38 mm, approaching the previously described â€œ35-mm ruleâ€□, suggesting this rule may be considered for use in CXR.

	Non-Occult Pneumothorax n = 161 (45.0%)	Occult Pneumothorax n = 197 (55.0%)	Cohort n = 358	*p*-value
Chest tube placed	104 (64.6)	56 (29.0)	160 (45.2)	**<0.001**
Failed observation	27 (26.0)	28 (50.0)	55 (34.4)	**0.001**
Chest tube timing				**0.01**
Prior to chest CT	77 (74.0)	27 (48.2)	104 (65.0)	
Within 24 hours of trauma	17 (16.3)	21 (37.5)	38 (23.8)	
Within 48 hours of trauma	5 (4.8)	3 (5.4)	8 (5.0)	
>48 hours after trauma	5 (4.8)	4 (7.1)	9 (5.6)	
Chest x-ray findings				
Apical size, mm	5.7 [0.0, 14.0]	N/A	0.0 [0.0, 4.0]	N/A
Lateral size, mm	0.0 [0.0, 8.3]	N/A	0.0 [0.0, 0.0]	N/A
Largest size, mm	8.6 [5.0, 18.0]	N/A	0.0 [0.0, 7.6]	N/A
Computed tomography (CT) obtained	137 (85.1)	184 (93.4)	321 (89.7)	**0.01**
Radial size, mm	14.1 [7.1, 32.3]	5.5 [3.0, 10.0]	8.2 [4.0, 18.5]	**<0.001**

Imaging and Management in Occult vs. Non-Occult Pneumothorax



AUROC curve of PTX size on CXR to predict TT need, with an AUC value of 0.75 (p<0.0001) and Youdenâ€™s index of 38 mm for optimal CXR PTX size cut off to predict TT.

Scientific Session IV

Paper #23
January 11, 2024
3:10 pm

IS RIB FRACTURE LOCATION AN UNDERUTILIZED COMPONENT OF BLUNT CHEST WALL TRAUMA TRIAGE?

Kelly Poirier, DO*, Alexandria Gallagher, DO*, John Getchell, BSN, Vani Parthiban, Michael Johns, DO*, Richard Caplan, PhD, Luis Cardenas, DO, PhD
ChristianaCare Health System

Presenter: Kelly Poirier, DO

Discussant: Jeff Choi, MD, MSc – Standford University

Objectives: Rib fractures represent up to 55% of blunt thoracic injuries and are associated with increased length of stay, pneumonia, and hospital mortality. Previous studies have shown that number of rib fractures, patient age and frailty play a greater role than location in patient morbidity. We investigated whether the location of rib fractures is an under-identified contributor to morbidity and mortality.

Methods: Included were single-institution 2015-2021 blunt trauma patients with > 1 rib fractures who had a chest CT scan. Excluded were patients with isolated 11th and/or 12th rib fractures, AIS Head/Neck > 4, penetrating injury, and chronic/existing rib fractures. Logistic regression analysis was performed for binary outcomes adjusting for total number of fractures, age, and ISS. Each location was analyzed separately as a binary variable. Results are reported as odds ratios (OR). Locations represent rib fractures on either side of the body.

Results: 1,285 patients met inclusion criteria from multiple blunt traumatic mechanisms. Demographics include: 61.8% male, median age 61 years, and median ISS=10, median number of Fractures = 4. Many patients had rib fractures in more than one location. Observed outcomes were 4.6% mortality, 3.5% pneumonia, 13% respiratory failure (>2 vent days), and 4.6% tracheostomy (Table 1). Patients with anterior rib fractures had statistically significant mortality and respiratory failure

Conclusions: Based on these results, anterior rib fractures were associated with greater respiratory failure and mortality. This confirms our hypothesis that the location of rib fractures, not just the quantity, is an important consideration in blunt chest trauma outcomes. This should lead to a revised rib fracture triage guideline to include age, frailty, quantity, and location. Included is a proposed guideline. (Table 2)

Table 1. Statistical importance of rib fracture location on various outcomes in blunt chest wall trauma

LOCATION (# FX)	MORTALITY (N=59) OR, P VALUE	PNEUMONIA (N=45) OR, P VALUE	TRACHEOSTOMY (N=59) OR, P VALUE	RESP FAILURE (N=167) OR, P VALUE
UPPER ANTERIOR (433)	2.07, p=0.02	1.37, p=0.33	1.25, p=0.45	1.68, p=0.01
UPPER LATERAL (497)	0.73, p=0.33	1.36, p=0.37	1.46, p=0.23	1.15, p=0.51
UPPER POSTERIOR (342)	0.66, p=0.23	1.07, p=0.86	1.70, p=0.08	1.19, p=0.41
LOWER ANTERIOR (281)	1.88, p=0.04	1.25, p=0.53	0.77, p=0.46	1.23, p=0.35
LOWER LATERAL (636)	0.62, p=0.13	1.44, p=0.28	1.11, p=0.73	0.89, p=0.58
LOWER POSTERIOR (514)	0.58, p=0.08	0.89, p=0.73	1.01, p=0.97	0.70, p=0.08

Table 2. Proposed chest wall trauma triage considerations

ICU	Step Down	Floor with Monitor
- 7 or more rib fractures - 5 or more rib fractures in patient > 65 years of age - IS < 60% of predicted value - Clinical frailty score 7-9 - Mechanically ventilated - Multiple major traumatic injuries - Oxygen saturation < 92 % on 6L nasal cannula or NIPPV to maintain saturation >92%	- 4-6 rib fractures - 2-4 rib fractures in patient > 65 years of age - IS < 75% of predicted value - Clinical frailty score 4-6 - Chest tube placement in patient > 65 years of age - Significant pulmonary contusion - 4-5 L nasal cannula to maintain oxygen saturation > 92%	- Less than 4 rib fractures - Vital capacity > 1000 ml on incentive spirometer - Clinical frailty score 1-3 - Less than 4 L nasal cannula to maintain O2 saturation > 92%
Consider upgrade in level of care in patients with high-risk features such as: anterior rib fractures, flail segment, pre-existing lung disease (COPD, asthma), smoker (current or past), pulmonary contusion on CT scan, hemothorax, pneumothorax, ability to mobilize, or chest tube		

Scientific Session IV

Paper #24
January 11, 2024
3:25 pm

SCANNING THE AGED TO MINIMIZE MISSED INJURY: AN EAST MULTICENTER STUDY

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MetroHealth Medical Center

Presenter: Vanessa P. Ho, MD, MPH, PhD, FACS

Discussant: Alexandra Briggs, MD – Dartmouth Hitchock Medical Center

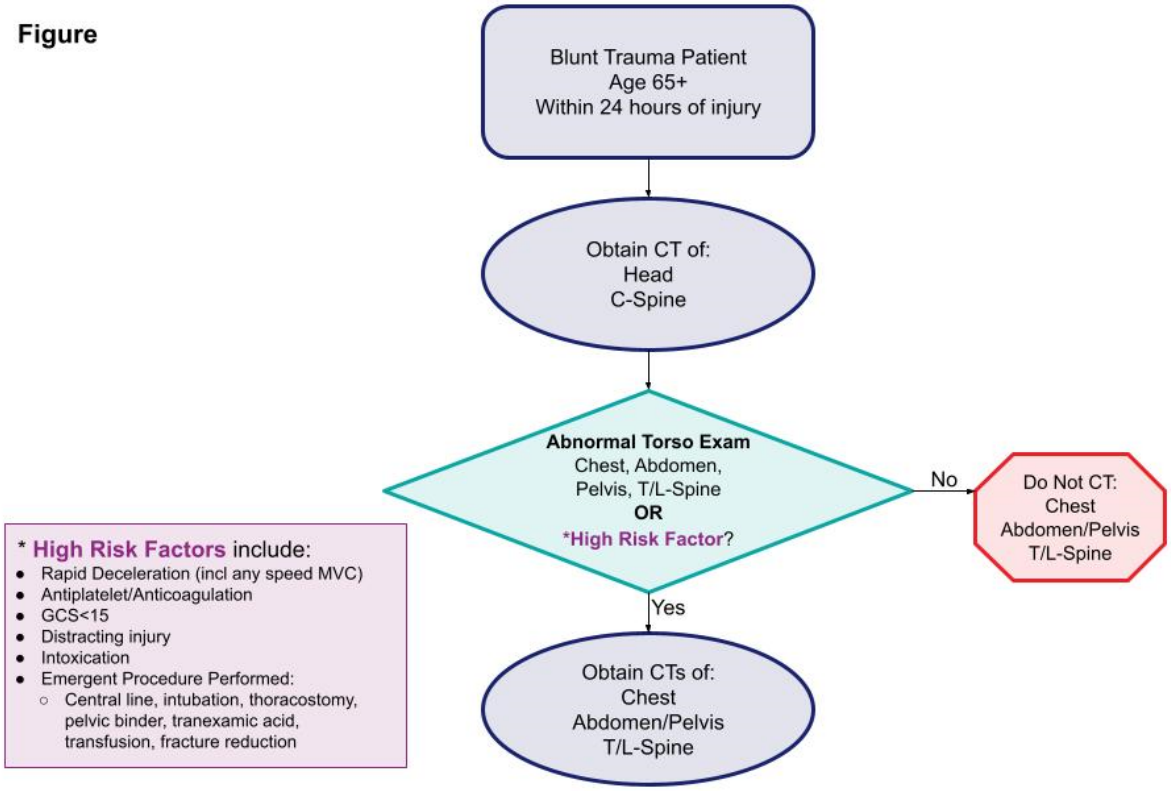
Objectives: Although older adults are frequently injured by blunt trauma, there is a lack of evidence-based guidance for computed tomography (CT) imaging in this population. This study aimed to identify a decision rule to guide use of a Pan-Scan (Head/C-spine + Torso) or a Tiered Scan (Head/C-spine ± Torso). We hypothesized that specific history and exam findings from the patient's initial evaluation could be used to guide imaging.

Methods: Our prospective study included blunt trauma patients aged 65+ at 18 Level I/II trauma centers. Patients presenting >24h after injury or who died upon arrival were excluded. We collected demographics, comorbidities, physical exams, injury mechanisms, and final injury diagnoses. Injury diagnoses were categorized into CT body regions of Head/C-spine or Torso (chest, abdomen/pelvis, and T/L spine). Using machine learning and regression modeling, we identified constellations of variables for a decision rule. Our priority was to identify a simple rule which could be applied at the bedside, maximizing sensitivity (Sens) and negative predictive value (NPV) (e.g., to minimize missed injuries).

Results: We enrolled 5,498 patients with 3,082 injuries. Nearly half (47.1%, n=2,587) had an injury within the defined CT body regions. No rule to guide a Pan-Scan could be identified with suitable Sens/NPV for clinical use. A high-quality model was identified to guide a Tiered Scan (Figure). This rule, applied amongst our patients, would identify injuries in all but 90 patients (1.6%). This strategy identified 96.0% of injuries, with Sens 94.3% and NPV 86.3%. Utilization of this tool would spare 11.9% (655) of blunt trauma patients a torso CT.

Conclusions: Our study highlights a decision rule with promising Sens and NPV to detect injuries in older blunt trauma patients, derived from a national cohort. Prospective validation of this rule could lead to streamlined diagnostic care of this growing trauma population.

Figure



Decision Rule

Scientific Session V

Paper #25
January 11, 2024
1:40 pm

IS BARBED BETTER? EVALUATION OF TRICLOSAN-COATED BARBED SUTURE ON WOUND COMPLICATIONS FOLLOWING EMERGENCY LAPAROTOMY

Joshua C. Dilday, DO*, Pat McGillen, MD, Stephen Park, MD, Shea Gallagher, MD, Heewon Lee, BS, Morgan Schellenberg, MD, MPH*, Kazuhide Matsushima, MD*, Kenji Inaba, MD, Matthew J. Martin, MD, FACS, FASMBS*
LAC+USC Medical Center

Presenter: Joshua C. Dilday, DO

Discussant: Caitlin Fitzgerald, MD – East Carolina University

Objectives: Emergent laparotomy is associated with significant wound complications including surgical site infections (SSI) and fascial dehiscence (FD). Triclosan-coated barbed suture (TCB) for fascial closure has been shown to reduce local complications but primarily in elective settings. We sought to evaluate the effect of TCB emergency laparotomy fascial closure on major wound complications.

Methods: Adult patients undergoing emergency laparotomy were prospectively evaluated over 1-year. Patients were grouped into TCB vs polydioxanone (PDS) for fascial closure. Subanalysis was performed on patients undergoing single-stage laparotomy. Primary outcomes were SSI and FD. Multivariate analysis identified independent factors associated with SSI and FD.

Results: Of the 206 laparotomies, 73 (35%) were closed with TCB and 133 (65%) were closed with PDS. Trauma was the reason for laparotomy in 73% of cases; damage control laparotomy (DCL) was performed in 27% of cases. The overall rate of SSI and FD was 18% and 10%, respectively. Operative strategy was similar between groups, including DCL, wound vac use, skin closure, and blood products. SSI events trended lower with TCB vs PDS closure (11% vs. 21%; p=.07), and FD was significantly lower with TCB versus PDS (4% vs. 14%; p<.05, Fig 1). Subanalysis of trauma and non-trauma cases showed no difference in SSI or FD. Multivariable analysis found that TCB decreased the likelihood of FD (OR .07; p<.05, Fig 2) following emergency laparotomy. Increased odds of FD were seen in DCL (OR 3.1; p<0.05).

Conclusions: Emergency laparotomy fascial closure with TCB showed significantly decreased rates of FD compared to closure with PDS, and a strong trend toward lower SSI events. TCB was independently associated with decreased FD rates after emergency laparotomy.

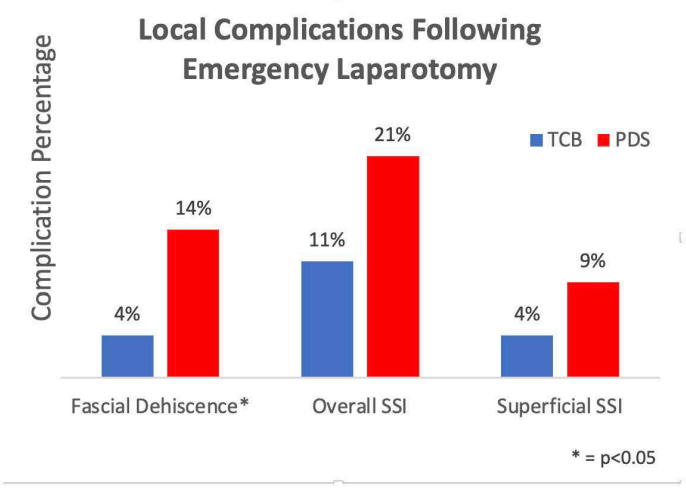


Figure 1: Local complications following emergency laparotomy

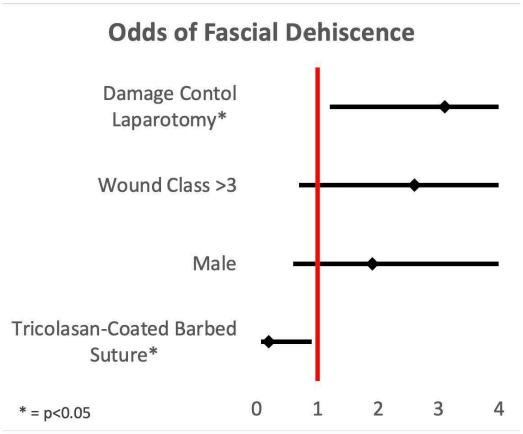


Figure 2: Odds of fascial dehiscence following emergency laparotomy

Scientific Session V

Paper #26
January 11, 2024
1:55 pm

TO CLOSE OR NOT TO CLOSE?: WOUND MANAGEMENT IN EMERGENT COLORECTAL SURGERY EAST MULTICENTER TRIAL

Cristina Feather, MD, MHS*, Rebecca S Allen, MD*, John Klune, MD, MBA*, Scott Rehrig, MD, Nadine Barth, MD, Emmalee Kugler, BS, Daniel C. Cullinane, MD*, Carolyne Falank, PhD, Bishwajit Bhattacharya, MD, FACS*, Adrian A. Maung, MD, FACS, FCCM*, Sirivan S. Seng, MD*, Asanthi M. Ratnasekera, DO, FACS*, Gary Alan Bass, MD, MBA, PhD, FEBS (EmSurg)*, Dale F Butler, MD, MBA, FACS*, Jose L. Pascual, MD, PhD, FRCS(C), FACS, FCCM*, Daniel Srikureja, MD, Nolan Winicki, MS, Jennifer Lynde, DO*, Brittany Nowak, MD, Faris K. Azar, MD*, Lauren A Thompson, DO*, Jeffry Nahmias, MD, MHPE, FACS, FCCM*, Morgan Manasa, MD, Ronald B. Tesoriero, MD*, Sandhya Kumar, MD, FACS, Morgan L. Collom, DO*, Michelle Kincaid, MD*, Kimberly Sperwer, DO, Ariel Santos, MD, MPH, FACS, FCCM*, Justin Turcotte, PhD, MBA,
Luminis Health

Presenter: Cristina Feather, MD, MHS

Discussant: Samuel Ross, MD, MPH – Carolinas Medical Center

Objectives: To determine the clinical impact of wound management technique on surgical site infection (SSI), hospital length of stay (LOS) and mortality in emergent colorectal surgery.

Methods: A prospective observational study (2021-2023) of urgent or emergent colorectal surgery patients at 15 institutions was conducted. Pediatric patients and traumatic colorectal injuries were excluded. Patients were classified by wound closure technique: skin closed (SC), skin loosely closed (SLC), or skin open (SO). Primary outcomes were SSI, hospital LOS and in-hospital mortality rates. Multivariable regression was used to assess the effect of wound closure on outcomes after controlling for demographics, BMI, ASA, procedure location and wound class. A priori power analysis indicated that 138 patients per group were required to detect a 10% difference in mortality rates.

Results: In total, 557 patients were included (SC n=262, SLC n=124, SO n=171). Statistically significant differences in BMI, race/ethnicity, ASA scores, procedure location, and wound class were observed across groups (Table 1). Overall, average LOS was 16.9 Â± 16.4 days, and rates of in-hospital mortality and SSI were 7.9% and 18.5%, respectively, with the lowest rates observed in the SC group (Table 2). After risk adjustment, SO was associated with increased LOS (Î²=3.89 days, p=0.032) and risk of mortality (OR=4.91, p<0.001), any SSI (OR=2.35, p=0.005), and dehiscence (OR=3.55, p=0.026), in comparison to the SC group. SLC was associated with increased risk of superficial SSI (OR=3.24, p=0.016), after risk adjustment.

Conclusions: When compared to the SC group, the SO group was associated with increased LOS, mortality, SSI, and dehiscence, while the SLC was associated with increased superficial SSI. Complete skin closure may be a viable wound management technique in emergent colorectal surgery.

Table 1. Demographics and Clinical Presentation by Wound Closure Type

Patient Characteristic – avg. ± SD or n (%)	All Patients (n=557)	Skin Closed (n=262)	Skin Loosely Closed (n=124)	Skin Open (n=171)	P-Value
Demographics					
Age (yrs)	58.5 ± 17.4	57.9 ± 17.3	61.3 ± 16.7	57.5 ± 17.9	0.141
BMI (kg/m^2)	28.3 ± 7.9	27.1 ± 7.3	28.2 ± 6.7	30.2 ± 9.0	**<0.001**
Female	261 (46.9)	117 (44.7)	66 (53.2)	78 (45.6)	0.268
Race/Ethnicity					
White	375 (67.3)	169 (64.5)	95 (76.6)	111 (64.9)	**0.044**
Black/African American	144 (25.9)	71 (27.1)	20 (16.1)	53 (31.0)	**0.013**
Asian	15 (2.7)	8 (3.1)	6 (4.8)	1 (0.6)	0.053*
Native Hawaiian or Other Pacific Islander	3 (0.5)	2 (0.8)	0 (0.0)	1 (0.6)	1.000*
Other	26 (4.7)	14 (5.3)	4 (3.2)	8 (4.7)	0.654
Hispanic Ethnicity**	61 (11.7)	41 (16.1)	8 (6.6)	12 (8.2)	**0.008**
Past Medical History					
Diabetes Mellitus	107 (19.2)	47 (17.9)	23 (18.5)	37 (21.6)	0.620
Liver Disease	28 (5.0)	12 (4.6)	5 (4.0)	11 (6.4)	0.584
Chronic Kidney Disease	68 (12.2)	33 (12.6)	11 (8.9)	24 (14.0)	0.395
Chronic Steroid Use	26 (4.7)	7 (2.7)	10 (8.1)	9 (5.3)	0.058
Congestive Heart Failure	42 (7.5)	15 (5.7)	11 (8.9)	16 (9.4)	0.307
Myocardial Infarction	31 (5.6)	8 (3.1)	8 (6.5)	15 (8.8)	**0.036**
Chronic Pulmonary Disease	72 (12.9)	33 (12.6)	15 (12.1)	24 (14.0)	0.866
Peripheral Vascular Disease	31 (5.6)	16 (6.1)	8 (6.5)	7 (4.1)	0.596
Stroke	38 (6.8)	18 (6.9)	7 (5.6)	13 (7.6)	0.805
Chronic Anticoagulation or Dual Antiplatelet Therapy	67 (12.0)	37 (14.1)	13 (10.5)	17 (9.9)	0.355
Rheumatic or Connective Tissue Disorder	17 (3.1)	9 (3.4)	5 (4.0)	3 (1.8)	0.471
Cancer	121 (21.7)	71 (27.1)	24 (19.4)	26 (15.2)	**0.010**
Chemotherapy	33 (5.9)	20 (7.6)	6 (4.8)	7 (4.1)	
Current Smoker	61 (11.0)	26 (9.9)	13 (10.5)	22 (12.9)	0.621
Prior Abdominal Surgery	156 (28.0)	72 (27.5)	36 (29.0)	48 (28.1)	0.951
ASA ≥ 3	166 (32.0)	58 (23.5)	34 (28.3)	74 (48.7)	**<0.001**
Malnourished***	143 (31.8)	59 (27.7)	35 (33.0)	49 (37.4)	0.163
Surgery Details					
Procedure Location(s)					
Right Colon	207 (37.2)	113 (43.1)	31 (25.0)	63 (36.8)	**0.003**
Left Colon	331 (59.4)	146 (55.7)	83 (66.9)	102 (59.6)	0.111
Rectum	45 (8.1)	16 (6.1)	11 (8.9)	18 (10.5)	0.240
Other	79 (14.2)	38 (14.5)	16 (12.9)	25 (14.6)	0.898
Wound Class					
Clean	25 (4.5)	21 (8.0)	2 (1.6)	2 (1.2)	**<0.001**
Clean Contaminated	169 (30.3)	119 (45.4)	26 (21.0)	24 (14.0)	**<0.001**
Contaminated	117 (21.0)	52 (19.8)	21 (16.9)	44 (25.7)	0.153
Dirty/Infected	246 (44.2)	70 (26.7)	75 (60.5)	101 (59.1)	**<0.001**
Estimated Blood Loss >500 ml	88 (15.8)	41 (15.6)	9 (7.3)	38 (22.2)	**0.002**
P-values <0.05 in bold					
One-way ANOVA performed to compare continuous measures across groups; Chi-square performed to compare categorical measures.					
*Fisher's exact test performed (assumptions of Chi-square not met).					
**Ethnicity data recorded in 521 patients.					
***Albumin <3. Albumin recorded in 450 patients.					
BMI – Body Mass Index					
ASA – American Society of Anesthesiologists Score					

Table 2. Outcomes by Wound Closure Type

Outcome Measure – avg. ± SD or n (%)	All Patients (n=557)	Skin Closed (n=262)	Skin Loosely Closed (n=124)	Skin Open (n=171)	P-Value
Any SSI	103 (18.5)	36 (13.7)$_a$	26 (21.0)$_{a,b}$	41 (24.0)$_b$	**0.020**
Superficial SSI	33 (5.9)	11 (4.2)$_a$	15 (12.1)$_b$	7 (4.1)$_a$	**0.004**
Deep SSI	13 (2.3)	4 (1.5)	1 (0.8)	8 (4.7)	0.068*
Organ/Space SSI	70 (12.6)	30 (11.5)$_a$	10 (8.1)$_a$	30 (17.5)$_a$	**0.040**
Enteric Fistula	9 (1.6)	1 (0.4)	3 (2.4)	5 (2.9)	0.056*
Fascial Dehiscence	24 (4.3)	6 (2.3)	6 (4.8)	12 (7.0)	0.050
In-Hospital Mortality	44 (7.9)	7 (2.7)$_a$	6 (4.8)$_a$	31 (18.1)$_b$	**<0.001**
Home Discharge**	343 (66.9)	185 (72.5)$_a$	85 (72.0)$_a$	73 (52.1)$_b$	**<0.001**
Hospital Length of Stay (days)	16.9 ± 16.4	14.5 ± 12.0$_a$	16.4 ± 15.5$_a$	21.0 ± 21.3$_b$	**<0.001**
Unplanned Return to OR	49 (8.8)	18 (6.9)	9 (7.3)	22 (12.9)	0.078
30 Day Unplanned Readmission	90 (16.2)	37 (14.1)	21 (16.9)	32 (18.7)	0.431
Follow-up Time (days)	51.3 ± 73.5	50.5 ± 74.3	55.2 ± 67.4	49.7 ± 76.9	0.798
P-Values <0.05 in bold					
One-way ANOVA performed to compare continuous measures across groups; Chi-square performed to compare categorical measures.					
*Fisher's exact test performed (Assumptions of Chi-square not met).					
Subscripts describe post-hoc Bonferroni adjusted differences between groups. Different letters represent statistically significant differences between groups.					
**Excludes in-hospital mortalities (n=513)					

Scientific Session V

Paper #27
January 11, 2024
2:10 pm

A RETROSPECTIVE COMPARISON OF THE KING LARYNGEAL TUBE AND I-GEL SUPRAGLOTTIC AIRWAY DEVICES FOR INJURED PATIENTS

Tanner Smida, BS, NREMT-A, Remle Crowe, PhD, Brad Price, PhD,
Jeffrey Oury, MD*, James M. Bardes, MD*
West Virginia University

Presenter: Tanner Smida, BS, NREMT-A

Discussant: Leah Tatebe, MD – Northwestern University

Objectives: Following trauma, advanced airway management may be required to ensure airway patency and prevent aspiration. Supraglottic airway devices (SGAs) are often used in the prehospital setting as both first-line and 'rescue' devices following failed endotracheal intubation. We aimed to compare the two most commonly used SGAs in the setting of trauma.

Methods: We used the 2018-2022 ESO public use datasets for this study. All trauma patients not in cardiac arrest prior to i-gel or King-LT placement were evaluated. We excluded patients with <2 SpO_2 values recorded following SGA placement. Our primary outcome was post-airway hypoxia (SpO_2<90%). Secondary outcomes included severe hypoxia (SpO_2<80%), first pass airway success, prehospital cardiac arrest, and survival to hospital discharge. We used logistic regression models adjusted for age, weight, use of airway suction, pre-SGA hypoxia, and whether the airway was placed as a 'rescue' device for our analyses. Patients that had attempted placement of a King-LT were used as a reference group.

Results: 1,557 patients were included in our primary analysis (1,054 i-gel, 503 King-LT). After SGA placement, 752 (48.3%) patients experienced hypoxia and 345 (22.2%) experienced severe hypoxia. Use of the i-gel was not associated with post-airway hypoxia (aOR: 0.96 [0.76, 1.22]), severe hypoxia (aOR: 1.03 [0.77, 1.37]), prehospital cardiac arrest (aOR: 0.88 [0.71, 1.10]; n=3,124), or survival to hospital discharge (aOR: 1.32 [0.81, 2.13]; n=494). Use of the i-gel was associated with increased first pass airway success (aOR: 1.60 [1.27, 2.01]; n=3,124).

Conclusions: Use of the i-gel was not associated with post-SGA hypoxia, prehospital cardiac arrest, or survival to hospital discharge. However, use of the i-gel in the setting of trauma was associated with improved first pass success in comparison to use of the King-LT.

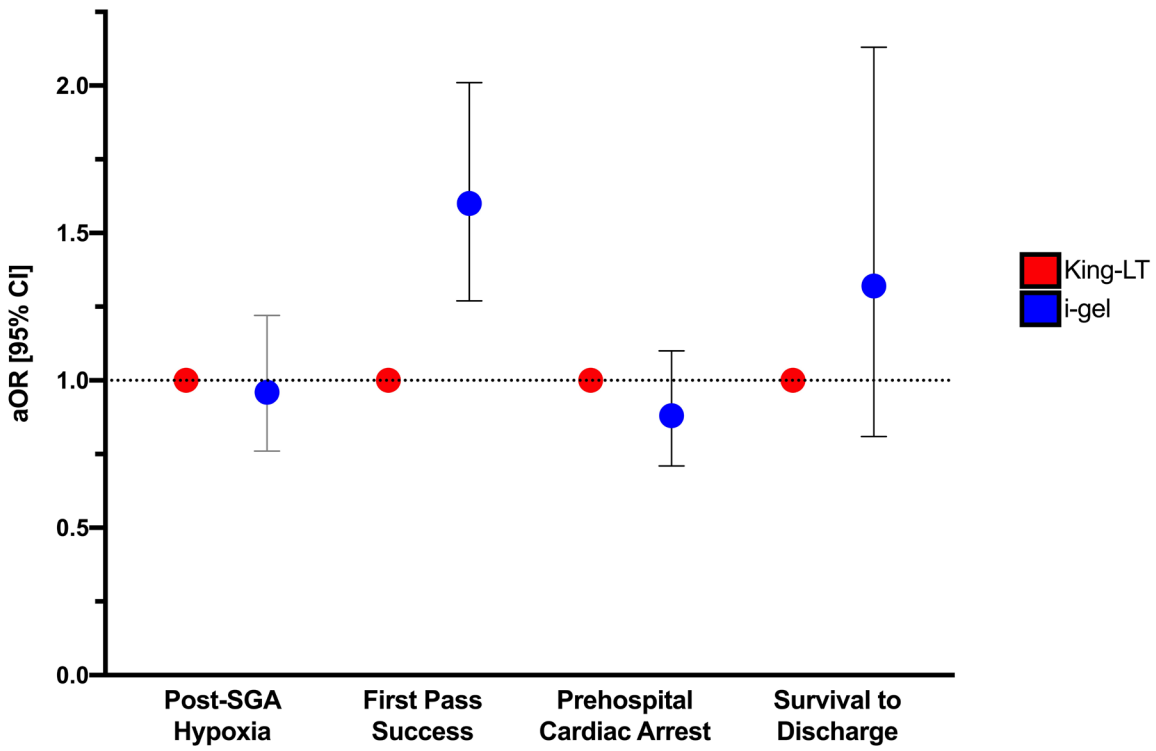


Figure 1: Multivariable logistic regression analysis.

Our multivariable logistic regression models were adjusted for age, weight, the use of suction during airway management, the presence of pre-SGA hypoxia, and whether the airway was placed as a first-line or rescue device for our analyses. SGA = supraglottic airway.

Scientific Session V

Paper #28
January 11, 2024
2:25 pm

EFFECT OF CPR ON PERFUSION IN A PORCINE MODEL OF SEVERE HEMORRHAGIC SHOCK

Patrick Greiffenstein, MD*, Alexander C. Cavalea, MD*, Alison A. Smith, MD, PhD*, Olivia Warren, BS, Jenna Dennis, BS, Cadence Gatterer, BS, Danise Danos, Terrence Byrne, BS, Thomas Sharp, PhD, Amy Scarborough, BS, Paige Deville, MD, Keith Van Meter, MD, MPH
LSUHSC-New Orleans

Presenter: Patrick Greiffenstein, MD

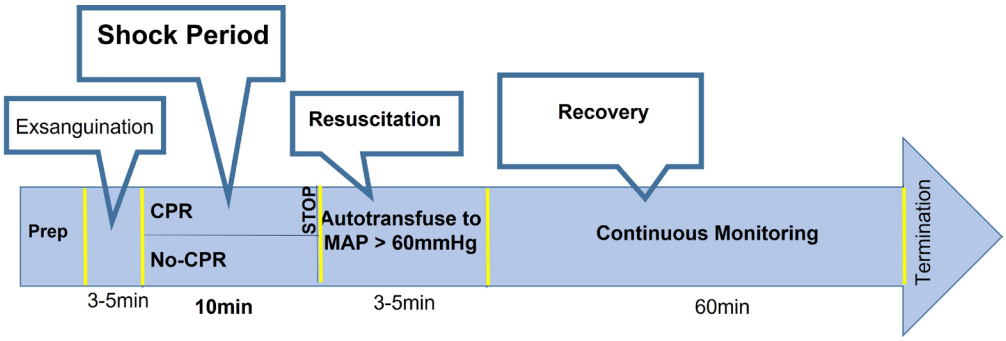
Discussant: Michael Wandling, MD, MS – The University of Texas at Houston

Objectives: The role of Cardiopulmonary Resuscitation (CPR) in hemorrhage causing pulseless electrical activity (PEA) is not clear. PEA from hemorrhage is a physiologically distinct clinical entity that has not been shown to benefit from CPR. Indeed, limited evidence suggests that CPR may be harmful. Our objective was to determine the effects of CPR on brain and skin oxygenation as a measure of perfusion in the setting of severe hemorrhagic shock using a porcine model.

Methods: Adult swine randomized to non-CPR (n=5) and CPR (n=6), were anesthetized. A transcranial probe was inserted into the parietal parenchyma and a transcutaneous probe was applied to the shoulder. Controlled hemorrhagic shock with mean arterial blood pressure (MAP) less than 30mmHg was achieved and allowed to persist for 10 minutes. Animals were randomized to either receive automated CPR or no treatment. They were then auto-transfused with sufficient blood to achieve MAP greater than 60mmHg. Measurements were obtained before, during, and after shock state. Outcomes were modeled using repeated measures ANOVA.

Results: Baseline characteristics were similar between groups. MAP during shock was similar between groups, however, the CPR Group had significantly higher systolic blood pressure (49.3 v. 66.5 mmHg) and lower diastolic blood pressure (32.1 v. 14.3 mmHg). Both cerebral (PbO_2) and skin oxygenation (TcO_2) dropped significantly as a result of shock and both were lower during shock in the CPR group, but this only reached significance during recovery (see Table).

Conclusions: Both transcutaneous and intracerebral oxygenation were significantly diminished during shock and adding CPR during did not improve end-organ shock perfusion, but did significantly affect perfusion during recovery. This experiment corroborates existing literature on the potential detrimental effects of CPR during hemorrhagic PEA, but further work is needed to confirm this observation.



Timeline for experimental procedures

	Shock			Recovery		
	no CPR	**CPR**	**p-value**	**no CPR**	**CPR**	**p-value**
Heart Rate	**73.63 (59.56,87.69)**	**112.98 (105.77,120.18)**	**<.0001**	77.97 (61.88,94.05)	76.69 (67.56,85.82)	0.8931
Systolic	**49.29 (42.21,56.38)**	**66.49 (60.61,72.36)**	**0.0005**	80.62 (73.11,88.12)	75.45 (69.13,81.76)	0.3139
Diastolic	**32.12 (26.89,37.36)**	**14.3 (10.13,18.47)**	**<.0001**	53.17 (47.61,58.74)	51.42 (46.86,55.99)	0.6644
MAP	36.96 (30.81,43.1)	35.37 (30.39,40.35)	0.7135	66.08 (59.6,72.55)	62.03 (56.68,67.38)	0.3762
TCO2 Shoulder	24.17 (14.82,33.52)	13.15 (4.5,21.8)	0.8127	**68.07 (58.15,77.99)**	**41.15 (31.74,50.56)**	**0.0015**
TCO2 Leg	21.64 (10.74,32.54)	19.81 (10.69,28.94)	0.1064	**67.51 (56.15,78.87)**	**41.5 (31.89,51.11)**	**0.0003**
pBO2	8.88 (4.1,13.67)	6.02 (1.64,10.4)	0.3860	**21.25 (16.31,26.19)**	**14.38 (9.82,18.94)**	**0.0463**

Table. Least Squared mean estimates and 95% confidence intervals during shock and recovery phases, from repeated measures ANOVA models.

Scientific Session V

Paper #29
January 11, 2024
2:40 pm

PREBOA VS ER-REBOA: THE IMPACT ON BLOOD UTILIZATION AND RESUSCITATION REQUIREMENTS: A PILOT ANALYSIS

Courtney H. Meyer, MD, MPH, Andrew N. Beckett, MD*, Elizabeth Benjamin, MD, PhD, Juan C. Duchesne, MD, FACS, FCCP, FCCM*, Rishi Kundi, MD*, Brad Dennis, MD, FACS*, Urmil Pandya, MD, FACS*, Ryan A. Lawless, MD*, Ernest Eugene Moore, MD*, M. Chance Spalding, DO, PhD, FACS*, William Vassey, MD
Morehouse School of Medicine

Presenter: Courtney H. Meyer, MD, MPH

Discussant: Peter Fischer, MD – University of Tennessee Health Science Center

Objectives: Partial occlusion of the aorta is a resuscitation technique designed to maximize proximal perfusion while allowing a graduated amount of distal flow to reduce the ischemic sequalae associated with complete aortic occlusion. The pREBOA catheter affords the ability to titrate perfusion as hemodynamics allows, however, the impact of partial occlusion on blood use and other resuscitative requirements is currently unknown. We hypothesize pREBOAs ability to provide partial occlusion, when appropriate, decreases overall resuscitative requirements when compared to ER-REBOA.

Methods: The entire AAST AORTA Registry was used to compare resuscitation requirements between all ER-REBOA and pREBOA. Unpaired t-tests, were used to compare resuscitation strategies including packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelets, cryoprecipitate, crystalloids, and need for pressors.

Results: When comparing ER-REBOA (n=795) use to pREBOA (n=155), initial patient presentation were similar except for age (42 vs 34 p=0.02) and rates of penetrating injury (21% vs 18% p=0.01), respectively (Table 1). Zone 1 occlusion tended to be used less often in the ER-REBOA group (65.8 vs 71.7 p=0.046). Partial occlusion was performed in 85% of pREBOA compared to 11% in ER-REBOA ($p<0.05$). The ER-REBOA group received significantly more units of PRBCs, FFP, platelets, and liters of crystalloids than the pREBOA group ($p<0.05$) (Figure 1).

Conclusions: When comparing pREBOA to ER-REBOA, there has been a rise in Zone-1 and partial occlusion. In our pilot analysis of the AORTA Registry, there was a reduction in administration of pRBC, FFP, platelets, and crystalloids. Though further prospective studies are required, this is the first to demonstrate an association between pREBOA, partial occlusion, and reduced blood use and resuscitative requirements.

	ER-REBOA (n=795)	pREBOA (n=155)	P-value
Age	44	40	0.03
Sex	23%	25%	0.71
% Penetrating	21%	18%	0.01
ISS	34	34	0.73
Initial SBP	79	83	0.36
Initial HR	97	104	0.076
Initial GCS	8	8	0.62
Prior CPR	20.2%	16.1%	0.25
Zone 1 Occlusion	65.8%	71.7%	0.046
% Partial REBOA	11.5%	85.6%	<0.001

Variables shown as average or percentage.
Injury Severity Scale (ISS), Systolic Blood Pressure (SBP), Heart Rate (HR), Glascow Coma Scale (GCS), Cardio-Pulmonary Arrest (CPR)

Table 1: Demographics, clinical presentation and injury severity among patients with ER-REBOA vs. pREBOA

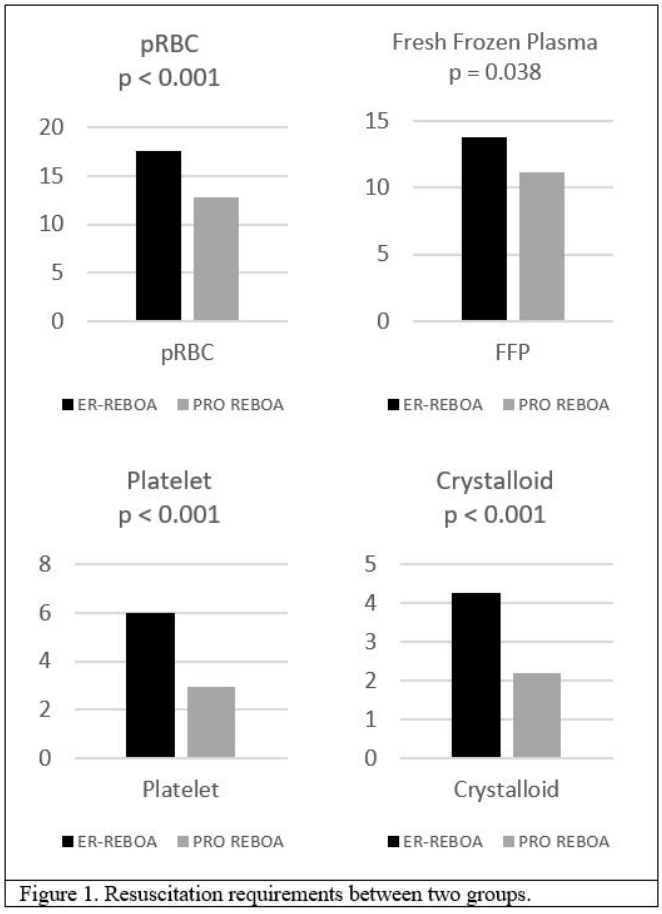


Figure 1. Resuscitation requirements between two groups.

Figure 1. Resuscitation requirements between two groups.

Scientific Session V

Paper #30
January 11, 2024
2:55 pm

AVOIDING A SECOND HIT: RESUSCITATION ADJUNCTS TO PREVENT POST-INTUBATION HYPOTENSION IN PATIENTS WITH ISOLATED TRAUMATIC BRAIN INJURIES

Tanya Anand, MD MPH*, Hamidreza Hosseinpour, MD, Adam C. Nelson, MD*, Sai Krishna Bhogadi, MD, Christina Colosimo, DO, MS, Malak Akl, BS, Audrey L. Spencer, MD*, Michael Ditillo, DO, FACS*, Louis J. Magnotti, MD*, Bellal Joseph, MD, FACS*
The University of Arizona College of Medicine, Tucson

Presenter: Tanya Anand, MD MPH

Discussant: Allyson Hynes, MD – University of New Mexico

Objectives: Post-intubation hypotension (PIH) is a potential complication of endotracheal intubation (ETI) among patients with traumatic brain injuries (TBI). This study aims to identify the resuscitation adjuncts which may prevent PIH Incidence.

Methods: This is a 4-year (2019-2022) prospective observational study at a level I trauma center. Adult(>18) patients with isolated TBI requiring ETI in the trauma bay were included. Blood pressures were measured 15 minutes pre- and post-intubation. Primary outcome was PIH, defined as any decrease in SBP > 20% from baseline or decrease in MAP to < 60 mmHg. A logistic regression was performed to identify the effects of pre-intubation vasopressors, HTS, PRBC, and crystalloids on PIH incidence.

Results: 490 patients were enrolled, of which 16% had mild (Head AIS < 2), 35% moderate (Head AIS 3-4), and 49% severe (Head AIS > 5) TBI. The mean age was 42±22 years and 71% were male. Median ISS, head-AIS, and GCS were 26[19-38], 4[3-5], and 6[3-11], respectively. Mean SBP 15 minutes pre- and post-intubation were 118±46 and 106±45, respectively. Prior to intubation, 31% received HTS, 10% received vasopressors, 20% received crystalloids, and 14% received at least one unit of PRBC (median, 2[1-2]U). 304 (63%) patients developed PIH. On multivariable regression analysis, pre-intubation use of vasopressors and HTS were associated with decreased odds of PIH regardless of TBI severity, while pre-intubation crystalloids and PRBC transfusion were not found to be protective for PIH (**Table**).

Conclusions: Every 2 in 3 patients with isolated TBI who require emergency ETI developed PIH. Pre-intubation administration of vasopressors and HTS were associated with decreased risk-adjusted odds of PIH. Given the deleterious effects of transient hypotension on the outcomes of TBI patients, early recognition of PIH and preventive measures are of paramount importance.

variables	aOR	95% CI	p-value
Vasopressor	0.39	0.10 – 0.94	**0.039**
Hypertonic Saline	0.39	0.21 – 0.70	**0.002**
Crystalloids	1.47	0.73 – 2.98	0.279
Packed Red Blood Cell (PRBC)	2.52	0.19 – 3.37	0.484

Independent Effect of Resuscitation Adjuncts on Post-Intubation Hypotension Incidence Among Patients with Isolated Traumatic Brain Injuries

Scientific Session V

Paper #31
January 11, 2024
3:10 pm

WHOLE BLOOD:TOTAL BLOOD PRODUCT RATIO IMPACTS SURVIVAL IN INJURED CHILDREN

Erin Feeney, MD, Katrina M Morgan, MD, Philip C. Spinella, MD, FCCM*,
Barbara A. Gaines, MD*, Christine M. Leeper, MD, MS*
University of Pittsburgh Medical Center

Presenter: Erin Feeney, MD

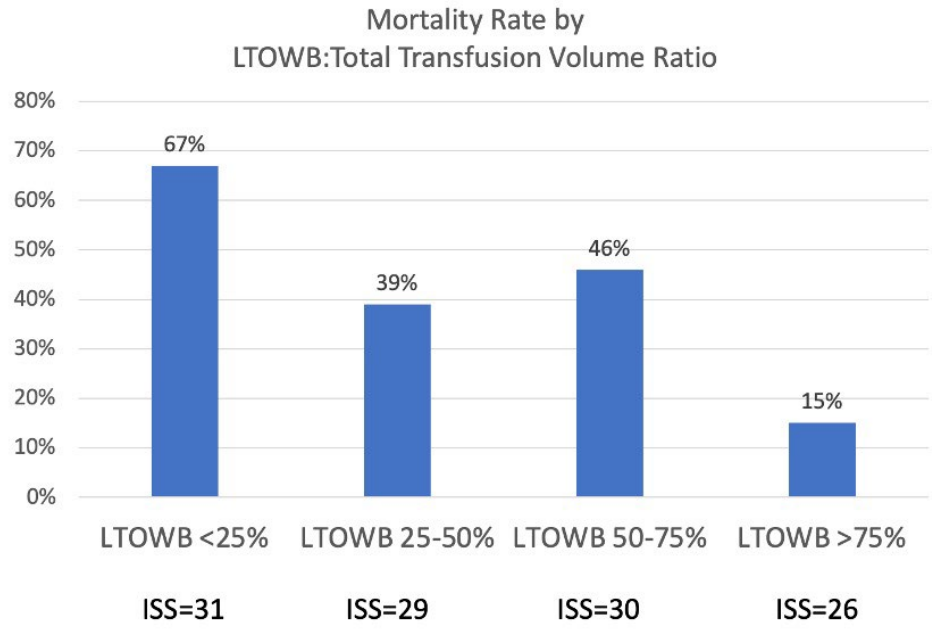
Discussant: Crisanto Torres, MD – Boston University School of Medicine/Boston Medical Center

Objectives: While the use of low titer group O whole blood (LTOWB) in children is increasing, guidelines for optimal hemostatic resuscitation in injured children have not been established.

Methods: The trauma database from a single academic pediatric level 1 trauma center was queried for pediatric (age<18 years) recipients of LTOWB after injury (years 2015-2022). Weight-based blood product (LTOWB, RBC, plasma and platelet) transfusion volumes during the first 24 hours of admission were recorded. The ratio of LTOWB to total transfusion volume was calculated. The primary outcome was in-hospital mortality. Multivariable logistic regression model adjusted for the following variables: age, sex, mechanism of injury, injury severity score, shock index, and Glasgow Coma Scale (GCS) score. Adjusted odds ratio representing the change in the odds of mortality by a 10% increase in the LTOWB:total transfusion volume ratio was reported.

Results: There were 95 pediatric LTOWB recipients included in the analysis, with median (IQR) age of 10 years (5-14), 58% male, median(IQR) injury severity score of 26 (17-35), 25% penetrating mechanism. The median(IQR) volume of LTOWB transfused was 17 (15-35) mL/kg. LTOWB comprised a median (IQR) of 59% (33-100) of the total blood product resuscitation. On unadjusted analysis, children with highest proportion of LTOWB in their resuscitation had the lowest mortality rate (FIGURE). After adjusting for age, sex, mechanism of injury, injury severity score, shock index, and GCS score, patients who received LTOWB had a 38% decrease in in-hospital mortality for each 10% increase in the proportion of WB within total transfusion volume ($p<0.001$) (AOR = 0.68, 95% CI 0.45 - 0.86).

Conclusions: Increased proportions of LTOWB within the total blood product resuscitation was independently associated with survival in injured children.


Mortality Rate by
LTOWB:Total Transfusion Volume Ratio
80%
70%
60%
50%
40%
30%
20%
10%
0%
67%
39%
46%
15%
LTOWB <25%
LTOWB 25-50%
LTOWB 50-75%
LTOWB >75%
ISS=31
ISS=29
ISS=30
ISS=26

Scientific Session V

Paper #32
January 11, 2024
3:25 pm

A QUALITY ASSESSMENT TOOL FOR FAST EXAMS USING ARTIFICIAL INTELLIGENCE

John Cull, MD, FACS*, Caleb Manasco, MD, John Eicken, MD, Ashley Vaughan*,
Dustin Morrow, MD, D Hudson Smith, PhD
Prisma Health Upstate

Presenter: John Cull, MD, FACS

Discussant: Caroline Park, MD, MPH – University of Texas Southwestern Medical Center

Objectives: Hospitals must perform quality reviews of FAST exams for quality assurance purposes. We aim to develop an assessment tool for FAST exams using Artificial Intelligence.

Methods: Five coders labeled a set of FAST clips. Each coder was responsible for a different subset of clips (10% of the clips were labeled in triplicate to evaluate inter-coder reliability). When forming the final dataset, majority voting was used to select the final code. Clips were disqualified in the case of a tie or if they contained non-standard FAST views. The clips were labeled with a quality score from 1 (lowest quality) to 5 (highest quality). Clips of 3 or greater were considered passing. A training model was developed to score the quality of the FAST exam. The clips were split into a training set, a validation set, and a test set. The model was scored using R^2 and mean-absolute error metrics. The predicted scores were rounded to the nearest quality level to distinguish passing from failing clips.

Results: The coders annotated a set of 3,071 FAST clips. Roughly 10% of the clips (n=276) were labeled in triplicate to evaluate inter-coder reliability. One coders samples were removed due to insufficient agreement with the other coders leaving a dataset of 1,976 clips. Non-standard FAST views (462) were removed from the data set leaving a total of 1,514 qualified clips (1,399 passing and 115 failing clips). This final dataset had a 94.4% agreement between pairs of coders on the pass/fail prediction and the set had a Krippendorff Alpha of 60%. The AI model had an R^2 score of 0.6 and a mean absolute error of 0.5 quality levels. On average, the model is wrong by half of a quality (the same level of agreement observed between the coders of the initial dataset). The model had an overall pass/fail accuracy of 95%.

Conclusions: AI is a promising tool for retrospectively grading US images for quality assurance purposes.

Scientific Session VI

Paper #33
January 12, 2024
8:15 am

DOES WHOLE BLOOD RESUSCITATION INCREASE RISK FOR VENOUS THROMBOEMBOLISM IN TRAUMA PATIENTS? A COMPARISON OF COMPONENT THERAPY VS WHOLE BLOOD IN 3468 PATIENTS

Brittany Hout, PA-C, Jan-Michael Van Gent, DO, Thomas Clements, MD,
Rebecca Rausa, PA-C, Carter Kaminski, DO, Thaddeus J. Puzio, MD*,
Julie Rizzo, MD, Bryan A. Cotton, MD, MPH
University of Texas Health Sciences Center

Presenter: Brittany Hout, PA-C

Discussant: Andrew Fisher, MD – New Mexico School of Medicine

Objectives: Whole blood (WB) resuscitation has been shown to provide mortality benefit and continues to be the go-to blood product in damage control resuscitation within the military. However, little is known on how WB transfusions impact venous thromboembolism (VTE) risk. We sought to investigate how different balanced resuscitation strategies affected VTE risk at two high volume trauma centers.

Methods: Trauma patients >15 years of age who were admitted 01/16-12/21 and received at least one unit of emergency-release blood product at two ACS level-1 trauma centers (one military, one civilian) were identified. Clinical characteristics and transfusion data were collected. Patients receiving any WB were compared to those who received only component therapy (COMP) in the form of red blood cells, plasma, platelets, or cryoprecipitate. The primary outcome was incidence of VTE (DVT and/or PE).

Results: 3468 patients met inclusion (WB-1775, COMP-1693). WB patients were younger (37 vs 40), had more penetrating injuries (38% vs 26%), transported by helicopter (50% vs 31%), and had higher ISS (26 vs 19); all $p<0.05$. WB patients were also more likely to get TXA (33% vs 15%), receive VTE chemoprophylaxis in < 48 hours (86% vs 79%), and lower 30-day survival (74% vs 84%); all $p<0.05$. While VTE incidence was similar (7% vs 9%; $p=0.13$), logistic regression revealed WB was protective against VTE, while RBC transfusions and TXA exposure increased VTE risk (TABLE). Each unit of WB had no impact on VTE, but each additional RBC increased the likelihood by 3%.

Conclusions: In this study from two level-1 trauma centers, the use of WB as part of an early resuscitation strategy was associated with a 30% reduction in VTE, while TXA was associated with a 2.5-fold increased risk. Empiric use of TXA should be used with caution in the setting of early whole blood resuscitation.

Likelihood of developing VTE in patients who receive any WB			
	Odds ratio	95% C.I.	p-value
WB exposure	0.70	0.54-0.91	0.009
TXA exposure	2.47	1.84-3.31	<0.001
RBC transfusions, per unit	1.08	1.05-1.11	<0.001
White race	1.35	1.03-1.75	0.025
Blunt trauma	1.09	0.81-1.47	0.574
Injury Severity Score	1.01	1.00-1.02	0.022
Likelihood of developing VTE per unit of WB transfused			
WB, per unit	1.04	0.97-1.10	0.266
RBC transfusions, per unit	1.03	1.01-1.04	<0.001
TXA exposure	1.88	1.38-2.56	<0.001
White race	1.42	1.08-1.86	0.011
Blunt trauma	1.11	0.81-1.51	0.506
Injury Severity Score	1.00	0.99-1.01	0.473

Likelihood of developing VTE in patients who receive any WB and per unit of WB transfused

Scientific Session VI

Paper #34
January 12, 2024
8:30 am

A COLLABORATIVE MULTIDISCIPLINARY TRAUMA PROGRAM IMPROVEMENT TEAM IMPROVES VTE CHEMOPROPHYLAXIS GUIDELINE COMPLIANCE IN STABLE TBI

Abdul Hafiz Al Tannir, MD, Elise Biesboer, MD*, Morgan Tentis, BS, Bryce Patin, BS, Morgan Maring, Patrick B Murphy, MD, MPH, MSc*, Daniel N. Holena, MD, MSCE, FACS*, Colleen M. Trevino, NP, PhD*, Jacob Peschman, MD*, David J. Milia, MD*, Marc A. de Moya, MD*, Rachel S. Morris, MD, FACS*
Medical College of Wisconsin

Presenter: Abdul Hafiz Al Tannir, MD

Discussant: Linda Reinhart, MSN, RN, CSN, CCRN, TCRN – Grandview Health

Objectives: Despite existing practice management guidelines recommending the initiation of venous thromboembolism (VTE) prophylaxis within 24-hours of stable head computed tomography (CT) in non-operative traumatic brain injury (TBI), delays in VTE prophylaxis occur out of concern for exacerbating intracranial hemorrhage. We hypothesized that the expansion of the Trauma Program Performance Improvement (PI) team will improve compliance of the 24-hour rule and will decrease VTE event in stable TBI.

Methods: This is a single-center retrospective review of all TBI patients admitted to a Level I trauma center before (2015-2016, early) and after (2019-2020, contemporary) the expansion of the Trauma PI team and the creation of trauma process and outcome dashboards. Exclusion criteria included discharge or death within 48 hours of admission, expanding hematomas, and a craniotomy prior to chemoprophylaxis initiation.

Results: A total of 1,272 patients met the inclusion criteria, of which 54% (n=682) were admitted after PI expansion. Following the addition of a dedicated PI nurse within the trauma program and creation of process dashboards, the time from stable CT to VTE prophylaxis initiation was shorter (38 vs 56 hours;$p<0.001$) and more patients received chemoprophylaxis within 24 hours (30% vs 10%;$p<0.001$) of stable head CT (Figure1). There was no significant difference in time from first head CT to stable CT (17 vs 18 hours;$p=0.11$). The contemporary group had a lower rate of VTE events (1% vs 4%;p-value<0.001) with no increase in bleeding events (3% vs 4%;p-value=0.25) (Figure2). On multivariable analysis, the early cohort was an independent predictor of VTE events (AOR: 3.7; 95%CI:1.5-9.7;p-value<0.001).

Conclusions: A collaborative multidisciplinary trauma PI team improves guideline compliance. Initiation of VTE chemoprophylaxis within 24-hours of stable head CT is safe and effective.

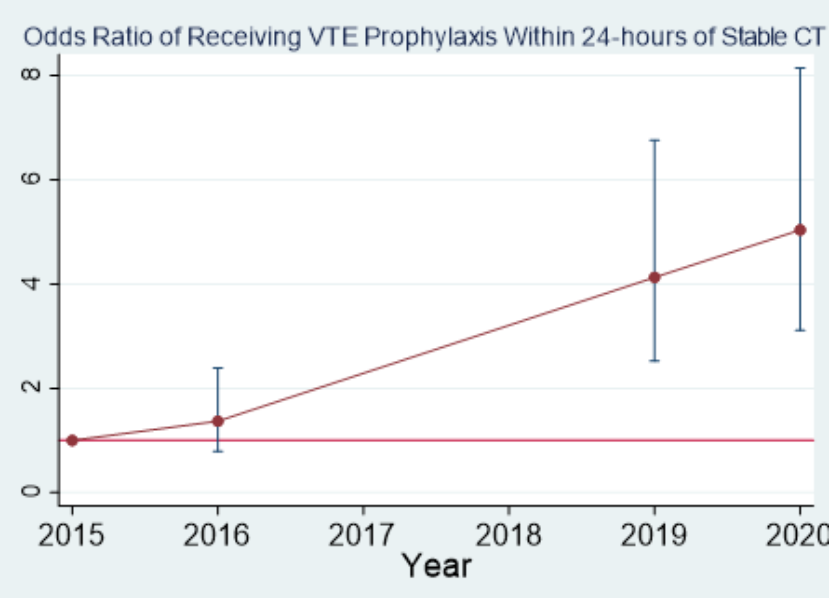


Figure 1. Odd's of Receiving VTE Prophylaxis Within 24-hours of Stable CT

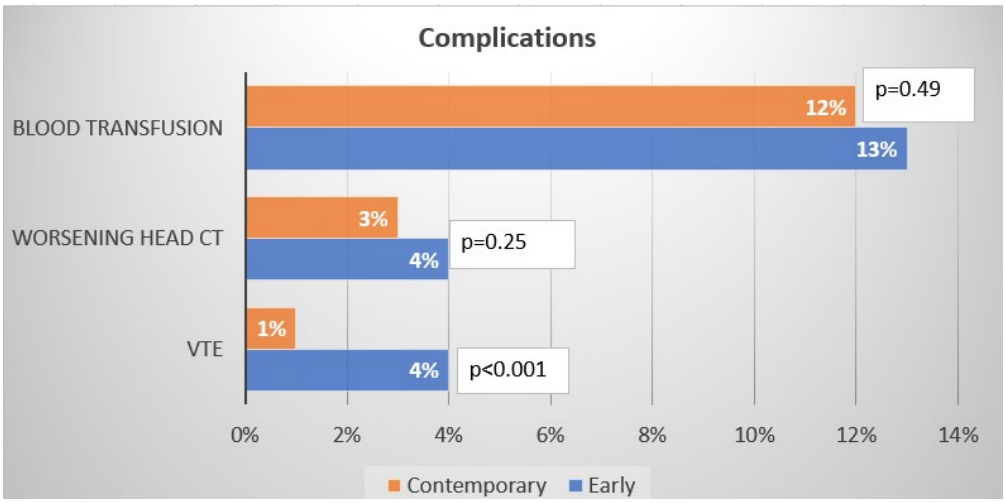


Figure 2. Comparison of VTE and Bleeding Events Across Both Cohorts

Scientific Session VI

Paper #35
January 12, 2024
8:45 am

EARLY VENOUS THROMBOEMBOLISM PROPHYLAXIS IS SAFE AND EFFECTIVE IN TRAUMA PATIENTS REQUIRING URGENT NEUROSURGICAL INTERVENTIONS: ANALYSIS OF THE PROSPECTIVE MULTICENTER CLOTT STUDY

Yutung Wu, MD, John Peter Gruen, MD, Kazuhide Matsushima, MD*, Morgan Schellenberg, MD, MPH*, Kenji Inaba, MD, Ernest Eugene Moore, MD*, Angela Sauaia, MD, PhD, M. Margaret Knudson, MD, Matthew J. Martin, MD, FACS, FASMBS*
Chang Gung Memorial Hospital, Linkou, Taiwan

Presenter: Yutung Wu, MD

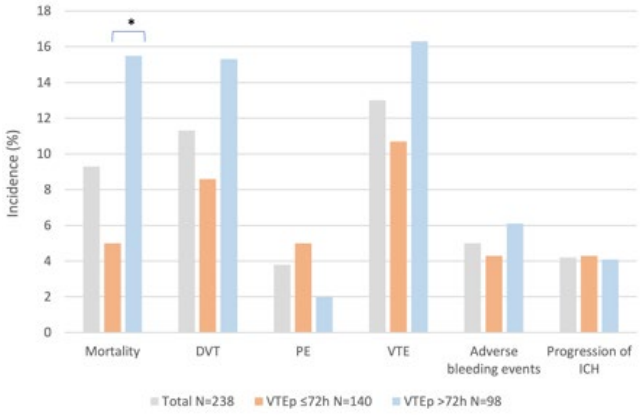
Discussant: Amanda Teichman, MD – Rutgers Robert Wood Johnson Medical School

Objectives: Timely initiation of venous thromboembolism prophylaxis (VTEp) decreases VTE after trauma, however, early VTEp in patients undergoing neurosurgical interventions (NSI) is controversial with conflicting reports in the literature from retrospective studies. We aimed to evaluate the safety and outcomes of early VTEp in this high-risk cohort.

Methods: The study was a secondary analysis from the prospective multicenter Consortium of Leaders in the Study of Traumatic Thromboembolism (CLOTT) database. Traumatic brain injury (TBI) patients receiving NSI were included. Patients were divided into early (≤72h) and late (>72h) VTEp groups. Mortality, VTE, deep vein thrombosis (DVT), pulmonary embolism (PE) and bleeding adverse events including intracranial hemorrhage (ICH) progression were compared.

Results: Among the 238 patients, 233 (97.9%) underwent craniotomy or craniectomy, and 140 (59%) had early VTEp. Patients with head abbreviated injury scale ≥5, heart rate >120/min, and craniectomy were more likely to postpone VTEp (>72h) (all $p<.05$). Compared to early VTEp, late VTEp had higher mortality (15.5% vs 5.0%, p=.013) in all patients (Figure) and also in the craniotomy/craniectomy group (15.8% vs 5.1%, p=.01). Early VTEp resulted in lower VTE (10.7% vs 16.3%, p=.284) and DVT trends (8.6% vs 15.3%, p=.16). The incidence of adverse bleeding events (early 4.3% vs late 6.1%, p=.558) or progression of ICH (4.3% vs 4.1%, p=1) was not increased with early VTEp. On multivariable regression, early VTEp had an odds ratio 0.36 (95% CI 0.12-1.09) for mortality, 0.65 (95% CI 0.28-1.53) for VTE, and 0.36 (95% CI 0.12-1.09) for DVT (Table).

Conclusions: Early VTEp is associated with a trend of lower mortality, VTE, and DVT rates for TBI patients requiring NSI. There was no increased risk of adverse bleeding or ICH progression with early VTEp.



DVT, deep vein thrombosis; PE, pulmonary embolism, VTE, venous thromboembolism, ICH, intracranial hemorrhage

*p=.013

Figure. The comparison of outcomes between early (≤72h) venous thrombo-embolism prophylaxis (VTEp) and late (>72h) VTEp.

	Adjusted Odds ratio	95% CI	p
Mortality	0.362	0.120-1.094	0.072
VTE	0.649	0.276-1.527	0.322
DVT	0.362	0.120-1.094	0.072
PE	3.617	0.589-22.219	0.165

VTE, venous thromboembolism; DVT, deep vein thrombosis; PE, pulmonary embolism

Table. The association of VTE prophylaxis ≤72h with different outcomes on multivariable logistic regression

Scientific Session VI

Paper #36
January 12, 2024
9:00 am

TIMING OF VTE PROPHYLAXIS AND COMPLICATIONS IN POLYTRAUMA PATIENTS UNDERGOING MAJOR ORTHOPEDIC SURGERY: A NATIONWIDE ANALYSIS

Anna Kobzeva-Herzog, MD, Ryan Kim, MD, Brian Gibbs, MD, Michael Kain, MD,
Aaron P. Richman, MD*, Dane R. Scantling, DO, MPH*, Noelle Saillant, MD*, Crisanto Torres, MD*
Boston University Medical Center

Presenter: Anna Kobzeva-Herzog, MD

Discussant: Jonathan Meizoso, MD, MSPH – Ryder Trauma Center/University of Miami

Objectives: There are no clear recommendations for timing of venous thromboembolism (VTE) pharmacologic prophylaxis initiation among polytrauma patients undergoing major orthopedic surgery with a high risk for perioperative bleeding, 5%-15% historical rate. Our study examined the association between timing of VTE prophylaxis and VTE complications in polytrauma patients undergoing major operative orthopedic interventions nationwide.

Methods: We performed a retrospective cohort study of trauma patients ≥ 18 years of age who underwent major orthopedic surgery for pelvic, hip, and femur fractures within 24 hours of admission at level I and II American College of Surgeons (ACS) verified trauma centers using the 2020 ACS-Trauma Quality Improvement Program (TWIP) databank. We assessed patients who received VTE prophylaxis within 12-24 hours of surgical intervention compared to VTE prophylaxis received more than 24 hours after surgical intervention. The primary outcome was VTE.

Results: The study included 4,735 patients who underwent major orthopedic operative intervention. The median time to VTE prophylaxis initiation was 33 hours (IQR 16,40). After adjustment for baseline patient, injury severity, and hospital characteristics, VTE prophylaxis initiated more than 24 hours from surgery was associated with increased odds of VTE (aOR 1.96; 95% CI 1.04-3.70). Earlier prophylaxis was not associated with an increased risk for surgical reintervention (aOR 0.84; 95% CI 0.58-1.23).

Conclusions: Delayed initiation of VTE prophylaxis was associated with developing VTE. Early VTE prophylaxis did not increase the risk of undergoing surgical reintervention. When considering timing of initiation of VTE prophylaxis in polytrauma patients, surgeons should weigh the risks of bleeding and need for operative reintervention against the risks of VTE complications.

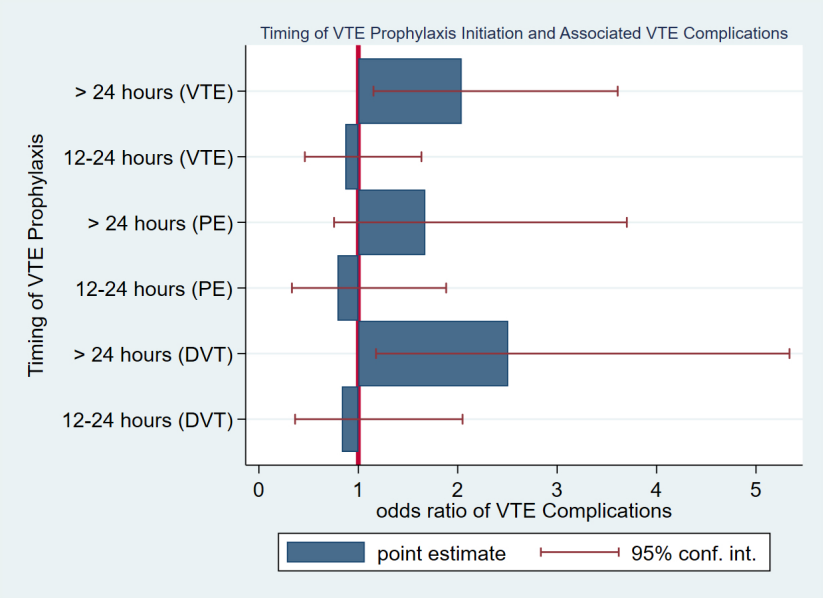


Figure 1: Timing of VTE Prophylaxis Initiation and Associated Odds of VTE Complications

Ref group: <12 hours*	12-24 hours n=2,002	> 24 hours n=763
Events, n (%)		
VTE	25 (1.2%)	28 (3.7%)
DVT	14 (0.7%)	19 (2.5%)
PE	12 (0.6%)	16 (2.1%)
Surgical Reintervention	78 (3.9%)	73 (9.5%)

Table 1. Description of Venous Thromboembolism and Surgical Reintervention Rates by Timing of VTE Prophylaxis

Scientific Session VI

Paper #37
January 12, 2024
9:15 am

IDENTIFYING PATIENT CHARACTERISTICS ASSOCIATED WITH DELAYS IN ORTHOPAEDIC PROCESS MEASURES

Nishant Gohel, MD, Pranav Khambete, MD, Laura Gerhardinger, MA, ANNA MILLER, MD, Philip R. Wolinsky, MD*, Molly P Jarman, PhD, MPH*, John W Scott, MD, MPH*, Rahul Vaidya, MD, Mark R. Hemmila, MD*
University of Michigan

Presenter: Nishant Gohel, MD

Discussant: Erik Barquist, MD - Extant Health

Objectives: Orthopaedic process measures (OPMs) are used in trauma quality improvement programs to assess the timeliness of proven interventions (e.g. femoral stabilization < 24 hours (H)). However, some patients do not meet these metrics and the reasons vary. We evaluated the patient characteristics that were associated with delays in achieving OPMs.

Methods: Data from a statewide quality improvement program from 1/2017 to 10/2022 was utilized. Adult patients (>18yrs) with a closed femur shaft or open tibial shaft fracture were analyzed. OPM delay was defined by not having a relevant procedure (e.g. femur fixation, open tibia debridement and fixation) within 24H. The effect of patient demographic, physiologic and treatment factors on procedural delay was assessed using a multivariable logistic regression. A sensitivity analysis of healthy patients (e.g. no ICU admit, ISS<15, etc.) with a delay was also performed.

Results: There were 5,199 patients with a femoral shaft fracture, 4,550 (87.5%) were operatively fixed, of those, 1,445 (31.8%) were delayed >24H. There were 1,219 patients with an open tibia fracture, 1,190 (92.2%) were fixed, 652 (50.5%) were debrided, and 133 (11.2%) and 122 (18.7%) were delayed. Also, 681 (47.1%) of femur patients were healthy but still had a delay. Older age, intubation status, hypertension and anti-coagulant use were associated with delays in femur stabilization. (Table)

Conclusions: We quantified the rate of not achieving an OPM and identified potential factors that might define a patient phenotype in which delays could be clinically justified. However, more concerning are the delays in healthy patients, which likely represent structural issues (e.g. operating room availability) that need further investigation. Capturing additional data about the reasons for these delays could shed light on what issues exist, better engage stakeholders, and guide necessary solutions.

Factors Associated with Delay (>24 hrs) in Femoral Stabilization		
Variable	**Odds Ratio (95% CI)**	**P value**
Age (reference 16-25 y)		
46-65 y	2.23 (1.56-3.19)	<0.001
65-75 y	3.09 (2.15-4.45)	<0.001
>75 y	3.29 (2.14-5.05)	<0.001
Intubated	2.47 (1.61-3.79)	<0.001
Hypertension (requiring meds)	1.37 (1.15-1.64)	<0.001
Anti-coagulant Use	1.67 (1.37-2.03)	<0.001
Functionally Dep. Health Status	1.56 (1.31-1.87)	<0.001
Disseminated Cancer	1.92 (1.02-3.64)	0.044
Blood Transfusion	0.52 (0.39-0.70)	<0.001

Scientific Session VI

Paper #38
January 12, 2024
9:30 am

AUTOLOGOUS SKIN CELL SUSPENSION COMBINED WITH MESHED AUTOGRAFT REDUCES DONOR SKIN REQUIREMENTS IN TRAUMATIC SOFT TISSUE DEFECTS

Taryn Elise Travis, MD, FACS*, Jeffrey Shupp, MD*, Jeffrey E. Carter, MD*,
Herb A. Phelan III, MD, FACS*
MedStar Washington Hospital Center

Presenter: Taryn Elise Travis, MD, FACS

Discussant: Charles C. Butts, MD – University of South Alabama

Objectives: The standard of care for acute full-thickness skin defects not amenable to primary closure is autologous split-thickness skin grafting (STSG). STSG harvesting creates additional donor site wounds with associated morbidity. An Autologous Cell Harvesting Device (ACHD) technology enables point-of-care preparation of a regenerative autologous skin cell suspension (ASCS). It has been demonstrated to reduce donor skin requirements in full-thickness thermal injuries by 32% compared to conventional STSG. We hypothesize that compared to standard of care STSG, ASCS in conjunction with a more widely meshed STSG in patients with full-thickness traumatic skin defects will result in similar healing and superior reduction in donor skin requirements.

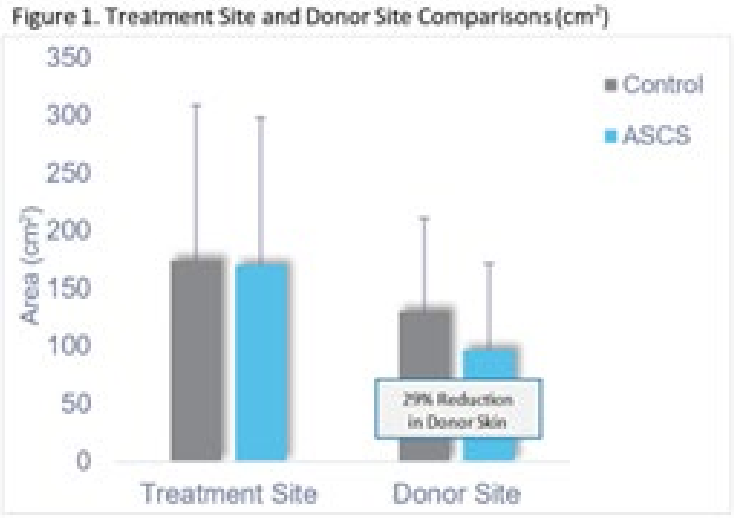
Methods: This was a multicenter, prospective, randomized, blinded evaluator, within-subject controlled study conducted under FDA IDE 13053. Patients > 5 years of age with acute full-thickness wounds requiring reconstruction with STSG were eligible for enrollment. Following wound bed preparation, two comparable treatment areas > 80 cm^2 were identified and a grafting plan established. Areas were randomized to treatment or control. The control area received treatment consistent with pre-identified grafting plan and the treatment area received ASCS in combination with STSG meshed more widely (i.e., 2:1 STSG vs 3:1 STSG + ASCS). Measured endpoints included healing at 8 weeks post-treatment and the ratio of donor skin to treatment area expansion.

Results: Sixty-five subjects were enrolled. Of these, 24 subjects had acute full-thickness traumatic skin defects. There was no significant difference in week 8 healing between treatment and control areas, despite use of 29% less donor skin for the ASCS treatment site.

Conclusions: The ACHD reduces donor skin needed for closure of traumatic full-thickness skin defects without compromise to healing outcomes.

Table 1. Subject Characteristics	
	Subjects N=24
Age (years)	
Mean ±	43.63 ±22.89
Median (Min, Max)	40.00 (15.00, 85.00)
Sex	
Male	54.2% (13/24)
Female	45.8% (11/24)
Race [(1)]	
White	66.7% (16/24)
Black Or African American	20.8% (5/24)
American Indian Or Alaska Native	8.3% (2/24)
Other	4.2% (1/24)
Risks for Impaired Healing [(1)]	
Obesity	41.7% (10/24)
Other	37.5% (9/24)
Diabetes	20.8 (5/24)
Current Smoker	16.7% (4/24)
Inadequate Nutrition/Malnutrition	16.7% (4/24)
None	12.5% (3/24)
[1] More than one option may apply so numbers might not total 100%	

Characteristics of study subjects.



Size in square centimeters of treatment sites and donor sites for control (standard STSG) and treated (widely meshed STSG + ASCS) areas.

Scientific Session VI

Paper #39
January 12, 2024
9:45 am

STOP THE BLEED FOR KIDS: A PEDIATRIC APPROACH TO THE NATIONAL EDUCATION CAMPAIGN

Melissa Anderson, MBA, BSN, RN*
Denver Health Medical Center

Presenter: Melissa Anderson, MBA, BSN, RN

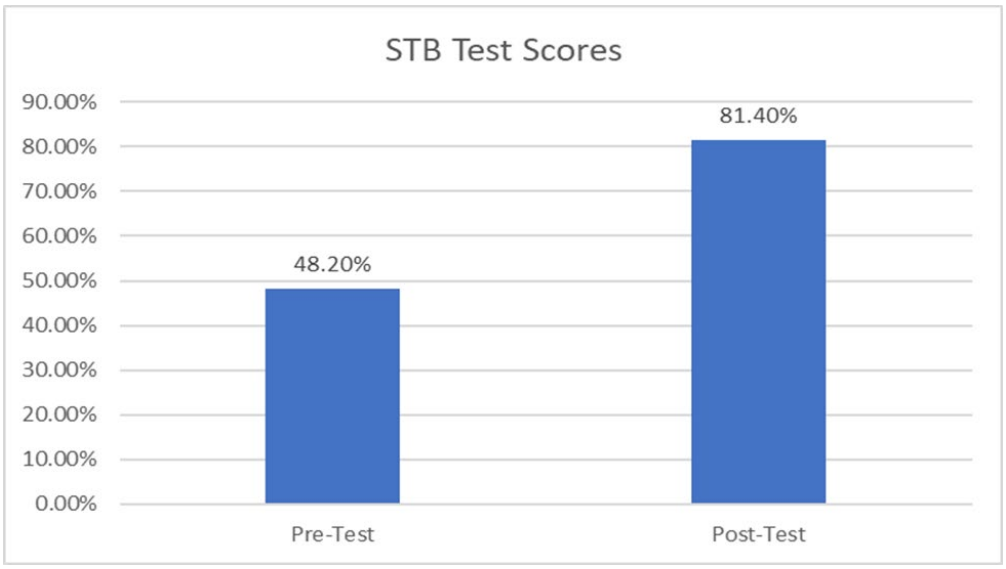
Discussant: Christina Colosimo, DO, MS – University of Arizona, Tuscan

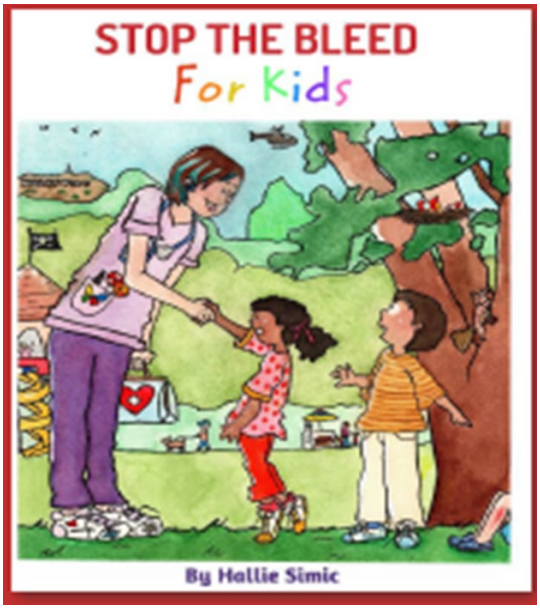
Objectives: Currently the national Stop the Bleed Initiative is focused on training high school age students and adults. However, children may be the first “on scene” of any type of incident. There is no national curriculum that trains younger children to perform the bleeding control tasks. Our objective was to create a pediatric friendly Stop the Bleed curriculum to provide children the necessary skills to assist in emergencies and empower them to have the confidence to help.

Methods: Typical Stop the Bleed Curriculum is 90 minutes and includes the PowerPoint presentation, video, hand-on training applying tourniquets, and packing wounds. The pediatric curriculum dismisses PowerPoint but keeps the hands-on training. Additionally, in the summer 2021: Safe Kids California coalitions were offered an educational grant to conduct readings of the Stop the Bleed children's book. Target audience was K-3rd. All grantees received copies of the book, pre and post tests, learning points, and activity sheets.

Results: Pilot program was tested on 500 children ages 5-13 years . Found 75% retention rate when the group was retested after 1 year. Goal is to provide multiple trainings over a year period to accomplish an 85-90% retention rate and target the most ideal age to start curriculum. Grant Data: Pre and Post tests for in-person or virtual readings included 6 questions regarding: safety emphasis, emergency numbers, response to different bleedings, materials for pushing and packing, tourniquet use, bleeding control steps, and ask their comfort level regarding helping someone that is bleeding. 10 schools were reached and there was an improvement in overall scores of 33.2%

Conclusions: There was a high rate of success for children age 5-13 years of understanding the concept of bleeding control. Additionally trainings will be necessary to continues to identify the ideal age for STB training


STB Test Scores
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
48.20%
81.40%
Pre-Test
Post-Test


STOP THE BLEED
For Kids
By Hallie Simic

Scientific Session VI

Paper #40
January 12, 2024
10:00 am

A MULTI-DIMENSIONAL APPROACH TO IDENTIFYING THE HIGHEST PERFORMING TRAUMA CENTERS ACROSS THE UNITED STATES

Doulia M Hamad, MD, Haris Subacius, Arielle Thomas, MD, MPH, MSc, Matthew Guttman, MD, PhD, Bourke Tillmann, MD, PhD, Angela Jerath, MD, MSc, Barbara Haas, MD, PhD*, Avery B. Nathens, MD, PhD, MPH*,
Department of Surgery, Sunnybrook Health Sciences Center and the University of Toronto

Presenter: Arielle Thomas, MD, MPH, MSc

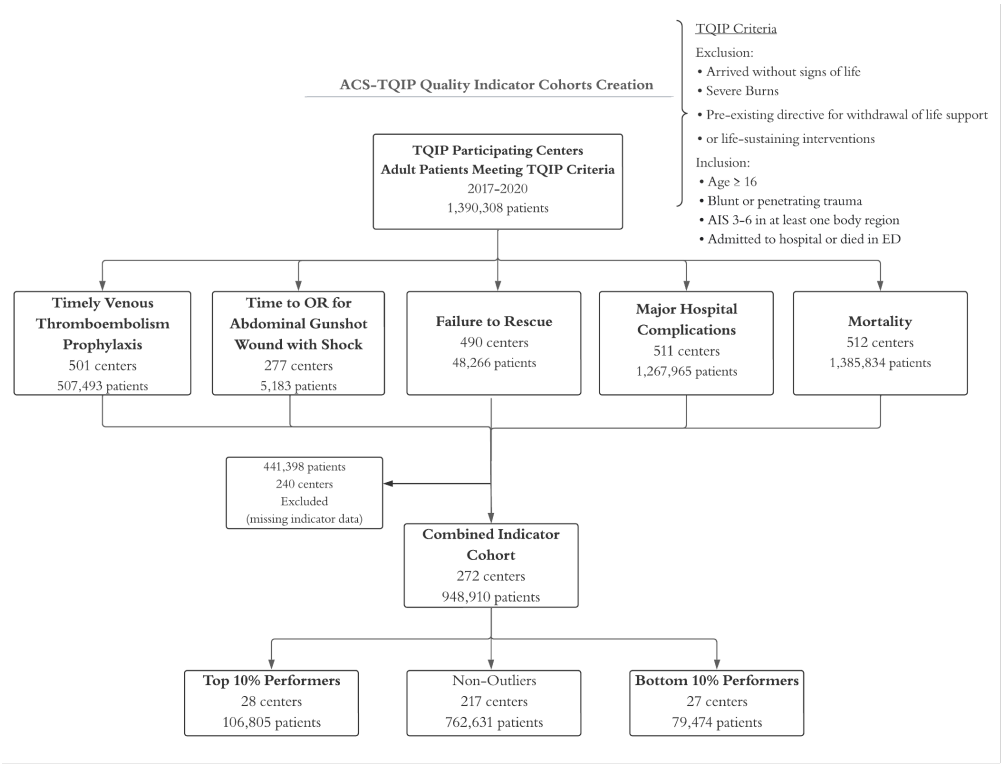
Discussant: Jessica Burgess, MD – Eastern Virginia Medical School

Objectives: The measurement of performance across several quality indicators offers better discrimination than a single indicator. We identified the attributes of high performing trauma centers using multiple dimensions of quality.

Methods: Using ACS-TQIP data from 2017-2020, we evaluated five quality measures for adult patients treated in level I and II trauma centers; 1) time to operating room (OR) for patients with abdominal gunshot wounds (GSW) with shock, 2) proportion of patients receiving timely venous thromboembolism (VTE) prophylaxis, 3) failure to rescue (death following a complication), 4) major hospital complications, and 5) mortality. Centers were ranked from most to least performant using risk-adjusted effect sizes. Ranks were summed into a composite score including all measures. Characteristics and risk-adjusted performance for the overall top and bottom 10% of centers were described.

Results: There were 272 centers meeting inclusion criteria, with 28 and 27 centers in the top and bottom 10%, respectively. Patients treated in high performing centers had lower odds of death (OR 0.62, 95% CI [0.55-0.70]), major complications (OR 0.68, 95% CI [0.56-0.81]) and failure to rescue (0.42, 95% CI [0.33-0.55]) compared to low performing centers. Time to OR for GSW was almost halved in high compared to low performing centers and rates of timely VTE prophylaxis were over two-fold greater. Top performing centers were almost twice as likely to be a level I center (71.4% vs 37.0%, p = 0.022) and cared for a higher number of severely injured patients (ISS >16) per annum (mean 417.33 vs 259.01 patients, p=0.034).

Conclusions: Our multi-dimensional approach sets a higher standard for trauma centers and shows an association between consistent high performance and structural factors, namely level I status and severely injured patient volume. Further work will investigate the cultural elements of these centers.



Cohort Selection Flowchart

	Bottom 10 percent	Top 10 percent	Non-Outliers	*p*
n (centers)	27	28	217	
Trauma Center Verification Level, n (%)				0.022
Level I	10 (37.0)	20 (71.4)	124 (57.1)	
Level II	17 (63.0)	8 (28.6)	93 (42.9)	
ISS $\geq$ 16 volume per annum (mean (SD))	259.0 (83.1)	417.3 (367.9)	341.5 (220.5)	0.034
ISS $\geq$ 25 volume per annum (mean (SD))	98.8 (34.8)	180.52 (169.6)	135.29 (91.9)	0.017
Total No. Pts/Center per annum (mean (SD))	735.9 (244.2)	953.6 (696.6)	878.6 (469.7)	0.131

Center Characteristics by Performance Group.

SD: Standard Deviation, IQR: Interquartile Range; p-values representing the comparison between Top 10% and Bottom 10%

Scientific Session VII

Paper #41
January 12, 2024
8:15 am

THE ROLE OF EMERGENCY DEPARTMENT THORACOTOMY IN PATIENTS WITH CRANIAL GUNSHOT WOUNDS

Justin S. Hatchimonji, MD, MBE, MSCE*, Nicole Meredyth, MD*, Sriharsha Gummadi, MD*, Elinore J. Kaufman, MD, MSHP*, Jay A. Yelon, DO*, Jeremy W. Cannon, MD, SM, FACS*, Niels D. Martin, MD*, Mark J. Seamon, MD, FACS*
University of Pennsylvania

Presenter: Justin S. Hatchimonji, MD, MBE, MSCE

Discussant: Lisa Kodadek, MD – Yale New Haven Health / Yale School of Medicine

Objectives: Although several society guidelines exist regarding emergency department thoracotomy (EDT), there is a lack of data upon which to base guidance for multiple gunshot wound (GSW) patients whose injuries include a cranial GSW. We hypothesized that survival in these patients would be exceedingly low, but some would proceed to organ donation.

Methods: We used Pennsylvania Trauma Outcomes Study (PTOS) data, 2002-2021, and included EDTs for GSWs. We defined EDT by ICD codes for thoracotomy or procedures requiring one, with a location flagged as ED. We defined head injuries as any head abbreviated injury scale (AIS) > 1 and severe head injuries as head AIS > 4. Head injuries were isolated if all other body regions AIS<2. Descriptive statistics were performed. Discharge functional status was measured in 5 domains.

Results: Over 20 years in Pennsylvania, 3,546 EDTs were performed, 2,771 (78.1%) in patients with penetrating injuries. Most penetrating EDTs (2,003, 72.3%) had suffered GSWs. Excluding *isolated* head wounds (n=25, 0% survival), 191/1,978 (9.7%) were head-injured. Survival to discharge was 5.3% for the non-head-injured (n=94/1,787), 2.6% for the head-injured (n=5/191, p=0.111 vs no head injury), and 0% for the severely head-injured (n=0/81, p=0.035 vs no severe head injury) (Figure). Of the 5/191 head-injured survivors, 2 were fully dependent for transfer mobility, and 3 were partially or fully dependent for locomotion. 1/186 (0.5%) head-injured patient was an organ donor.

Conclusions: Though there is clearly no role for EDT in patients with isolated penetrating head injuries, EDT may be considered in patients with combined injuries, as most of these patients have minor head injuries and survival is not different from the non-head-injured. However, if a severe head injury is clinically apparent, even in the presence of other body cavity injuries, EDT should not be pursued.

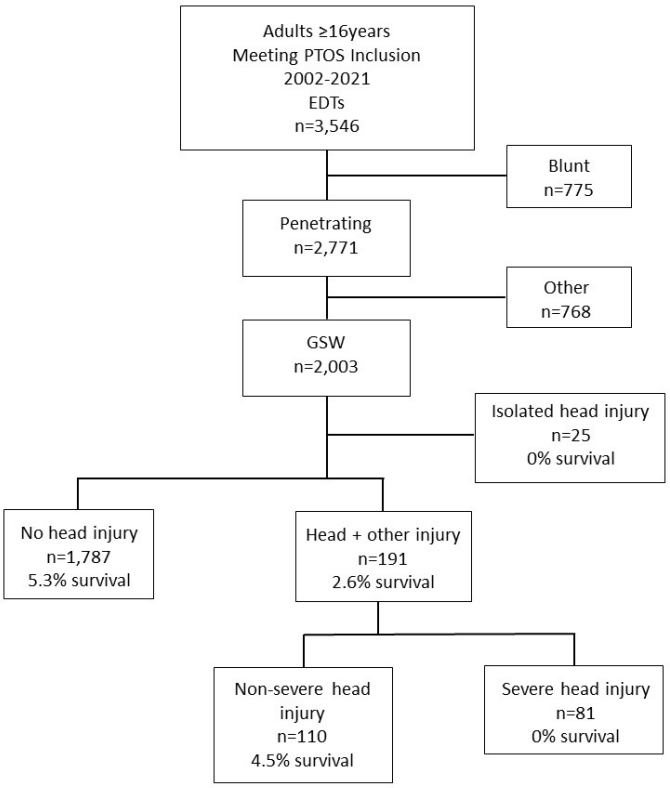


Figure. Flow diagram, mortality by injury pattern. PTOS, Pennsylvania Trauma Outcomes Study; EDT, emergency department thoracotomy; GSW, gunshot wound.

Scientific Session VII

Paper #42
January 12, 2024
8:30 am

ENDLESS HIGHWAYS: THE BURDEN OF TRANSFERRED TRAUMATIC BRAIN INJURY PATIENTS IN THE UNITED STATES

Sai Krishna Bhogadi, MD, Christina Colosimo, DO, MS, Hamidreza Hosseinpour, MD, Audrey L. Spencer, MD*, Qaidar Alizai, MD, Adam C. Nelson, MD*, Michael Ditillo, DO, FACS*, Louis J. Magnotti, MD, MS, FACS, Bellal Joseph, MD, FACS*
The University of Arizona

Presenter: Sai Krishna Bhogadi, MD

Discussant: Ayodele Sangosanya, MD, MBA – Yale-Bridgeport Hospital

Objectives: Wide variations exist in traumatic brain injury (TBI) management strategies and transfer guidelines across the country. This study aimed to assess the outcomes of TBI patients transferred to level I or level II trauma centers (LI/II TCs) on a nationwide scale. We hypothesized that most of these patients may not require interventions.

Methods: In this 4-year retrospective analysis of the ACS-TQIP database (2017-2020), adult isolated TBI (non-Head AIS=0) patients with intracranial hemorrhage (ICH) who were transferred to LI/LII TCs were included. Outcomes were rates of head computed tomography (CT) scans, neurosurgical interventions (ICP monitoring, craniotomy/craniectomy), hospital length of stay (LOS), and mortality. Descriptive statistics were performed.

Results: Of 117,651 TBI patients with ICH managed at LI/LII TCs, 53,108 (45%) transferred from other centers were identified. The mean (SD) age was 61 (22) years, and 60% were male. The median [IQR] GCS on arrival was 15 [14-15]; 10% had GCS 8 on arrival at the receiving trauma center. About 58% of the patients underwent head CT scans and 4% underwent repeat head CT scans. Nearly 4% received ICP monitoring, 12.5% underwent craniotomy/craniectomy, and 14% received mechanical ventilation. The median hospital LOS was 2 [1-5] days, and the mortality rate was 6.5%. Nearly 18% and 39% of the patients were discharged within 24 hours and 48 hours of admission respectively without undergoing any neurosurgical intervention. Nearly 51% of those discharged within 48 hours had at least 1 CT scan at the receiving trauma centers.

Conclusions: Half of the TBI patients managed at LI/LII TCs are transferred from lower-level hospitals. Over 1/3 of these transferred patients are discharged within 48 hours without any interventions. Our findings indicate the need for systemwide guidelines to improve healthcare resource utilization and for appropriate triage of TBI patients.

Scientific Session VII

Paper #43
January 12, 2024
8:45 am

IMPACT OF CATASTROPHIC BRAIN INJURY PROTOCOLS ON ORGAN DONATION RATES: RESULTS OF AN EAST MULTICENTER TRIAL

Kristen Nordham, MD, MS*, Danielle Tatum, PhD, Mayur B. Patel, MD, MPH, FACS*, Anil Paramesh, MD, MBA, Juan C. Duchesne, MD, FACS, FCCP, FCCM*, Jeffry Nahmias, MD, MHPE, FACS, FCCM*, Amelia W. Maiga, MD, MPH*, Allan B. Peetz, MD, MPH, FACS*, Pascal O. Udekwu, MD, MBA, MHA*, Anquonette Stiles, DC, MPH, Chloe Shell, BA, Joshua D. Stodghill, DO*, Taneen Maghsoudi, DO, Bryant McLafferty, MS, Erin Iacullo, MS, Erin Coonan, MD, Ryan M Boudreau, MD*, Steven A Zimmerman, MD*, Tanya Egodage, MD, FACS*, Patrick Morris, BS, Jacob Metheny, BS, Michael S Farrell, MD, MS*, Matthew D. Painter, MD, FACS*, Owen T. McCabe, MD*, Philomene Spadafore, MHA, RN, David Tai-Wai Wong, MD*, Jan Serrano, DNP, MHA, RN, CEN, MICN, CPST, Jason D. Sciarretta, MD, FACS*, Phillip Kim, MD, MBA*, Ryan Hayton, MD, Danessa Gonzales, MD, Jason Murry, MD*, Katelyn Meadows, RN, Lewis E. Jacobson, MD, FACS*, Jamie M. Williams, MSML BSN RN CCRP, Andrew C. Bernard, MD, FACS*, Brennan Smith, DO, Shawna L. Morrissey, DO*, Nilesh Patel, MD, Dina Tabello, DO*, Erik Teicher, MD FACS, A H M Sharfuddin Mahmud Chowdhury, MBBS, MMed, FCS(SA), FACS*, Fazal Ahmad, MBBS, MS, Basem S. Marcos, MD, FACS*, Michaela A. West, MD, PhD*, Tomas H. Jacome, MD*, Greggory Davis, PhD, Joshua A. Marks, MD*, Deviney Rattigan, MD*, James M. Haan, MD*, Kelly Lightwine, MPH, Kazuhide Matsushima, MD*, Stephen Park, MD, Ariel Santos, MD, MPH, FACS, FCCM*, Kripa Shrestha, MBBS, MPH, MS, Charles V. Bayouth, MD, FACS*, Robert Sawyer, MD*, Sheri VandenBerg, BS, RN, Robert Jean, MD, Chace Hicks, MD, Stephanie Lueckel, MD, ScM FACS, Elizabeth Tindal, MD, MPH*, Nikolay Bugaev, MD*, Wael Abosena, MD, Claudia Alvarez, MD, Melissa A Hornor, MD*, Victoria Dronzek, BS, Mark J. Lieser, MD*, Hannah McDonald, BA, Ryan P. Dumas, MD*, Caitlin A. Fitzgerald, MD*, William Thomas Hillman Terzian, MD*, Yuqian Tian, MD, Vasileios Mousafeiris, Francesk Mulita, Dalier Mederos, MD, John D. Berne, MD*, Nicole Garcia, MD*,
Alison A. Smith, MD, PhD*, Sharven Taghavi, MD, MPH, MS, FACS*
Tulane University School of Medicine

Presenter: Kristen Nordham, MD, MS

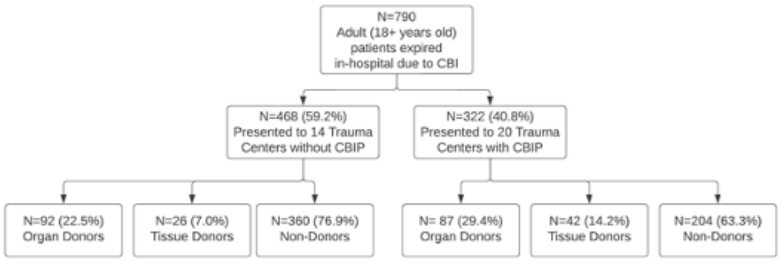
Discussant: Eric Mahoney, MD – Lahey Hospital and Medical Center

Objectives: One third of organ donors have suffered a catastrophic brain injury (CBI). Currently, there are no standard guidelines for the management of CBI and not all trauma centers use an institutional CBI protocol (CBIP). Additionally, there is high variability in management between institutions with CBIP, with some protocols including components such as hormone therapy, steroids, pressors, and fluid resuscitation. We hypothesized that centers with CBIP have higher organ donation rates than those without.

Methods: This prospective, observational EAST-sponsored multicenter trial included adult (18+ years old) CBI patients at 34 level I and II trauma centers from 1/22-5/23 (Fig 1a). CBI was defined as a brain injury causing loss of function above the brain stem and subsequent death. Logistic regression with clinically relevant variables determined if presence of CBIP was associated with organ donation.

Results: A total 790 patients from 34 participating centers met inclusion criteria (Fig 1a). In unadjusted comparison, CBIP centers had higher rates of organ donation, and higher use of early antibiotics, steroids, whole blood, and hormones (Fig 1b). Of the 322 patients at centers with CBIP, 206 (71.5%) were treated with hormone therapy and only 79 (24.4%) with steroids. On multivariate analysis, CBIP was not associated with organ donation, but variables associated with organ donation included registered donor status, lower emergency department GCS, hormone administration, and no comorbidities (Fig 2).

Conclusions: There is high variability in management of CBI at trauma centers, even at those with CBIP in place. While use of CBIP was not associated with increased organ donation, hormone therapy, a common element of CBIPs, was associated with donation. Improved standardization of management with CBIP may inform practices and increase organ donation rates nationwide.

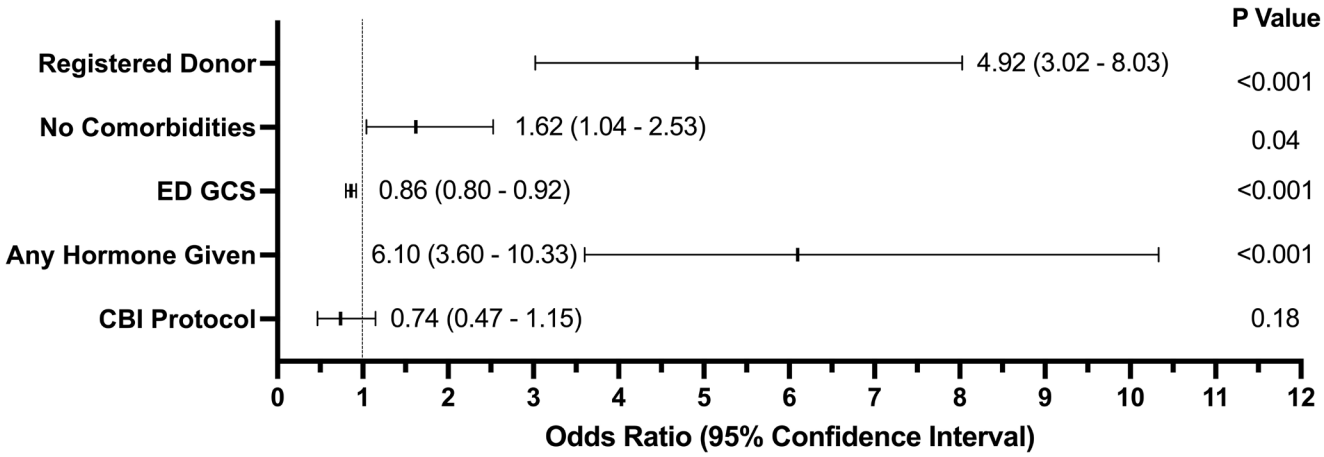


A.

	Total (n = 790)	No CBIP (n = 468, 59.2%)	CBIP (n = 322, 40.8%)	P Value
Registered donor	126 [18.7]	46 [12.0]	80 [27.4]	<0.001
ISS	29 (25 – 35)	29 (25 – 37)	27 (25 – 34)	0.03
AIS-Head	5 (4 – 5)	5 (4 – 5)	5 (4 – 5)	0.3
Antibiotics administered in 1st 24 hours	405 [55.1]	223 [50.8]	182 [61.5]	<0.01
Whole blood transfused	60 [8.1]	27 [6.1]	33 [11.3]	0.01
Any hormone administered	422 [59.8]	216 [51.7]	206 [71.5]	<0.001
Steroid administered	137 [18.8]	65 [14.9]	72 [24.4]	<0.001
Vasopressin administered	314 [43.0]	171 [39.3]	143 [48.5]	0.01
Desmopressin administered	159 [21.8]	97 [22.2]	62 [21.0]	0.69
T4 administered	126 [17.3]	45 [10.4]	81 [27.5]	<0.001
Dopamine administered	41 [5.6]	13 [3.0]	28 [9.5]	<0.001
Approach for organ consent	267 [50.5]	148 [47.6]	119 [54.6]	0.11
Approach for tissue consent	189 [41.4]	101 [37.1]	88 [47.8]	0.02
Next-of-kin consent obtained	195 [74.7]	101 [71.1]	94 [79.0]	0.15
Organ donation	179 [25.4]	92 [22.5]	87 [29.4]	0.04
Tissue donation	68 [10.2]	26 [7.0]	42 [14.2]	<0.01

B.

(A) Flow chart showing number of patients at CBIP and non-CBIP centers and organ/tissue donation outcomes. (B) Characteristics and outcomes at CBIP and non-CBIP trauma centers. CBI: Catastrophic Brain Injury, CBIP: CBI Protocol, ISS: Injury Severity Score, AIS: Abbreviated Injury Score.



Multivariate logistic regression for factors associated with organ donation in CBI patients.

Scientific Session VII

Paper #44
January 12, 2024
9:00 am

BLUNT CEREBROVASCULAR INJURY: THE ROLE OF NUMBER AND LATERALITY OF AFFECTED VESSELS ON RADIOLOGIC AND CLINICAL OUTCOMES

Hamidreza Hosseinpour, MD, Louis J. Magnotti, MD*, Dih-Dih Huang, MD*, Jordan A. Weinberg, MD*, Qaidar Alizai, MD, Collin H. Stewart, MD*, Marc R. Matthews, MD, MS, MCG, FACS, FASGS, Christina Colosimo, DO, MS, Tanya Anand, MD MPH*, Bellal Joseph, MD, FACS*
The University of Arizona College of Medicine, Tucson

Presenter: Hamidreza Hosseinpour, MD

Discussant: Stefan Leichtle, MD, MBA – Inova Health System

Objectives: The effect of the number and laterality of injured vessels on outcomes of blunt cerebrovascular injuries (BCVIs) is unclear. We hypothesized that multiple and bilateral injured vessels tend to progress on repeat imaging and have worse clinical outcomes compared to single and unilateral injuries.

Methods: This is a retrospective study at two ACS level I trauma centers (2017-2021). Adult(>16yr) trauma patients were screened by Expanded Denver Criteria and injuries were graded by Denver Scale based on the initial computed tomography angiography (CTA). Early repeat CTA was performed 7-10 days after diagnosis. Patients were stratified by the number (Single vs. Multiple) and laterality (Unilateral vs. Bilateral) of the involved vessels. Outcomes included progression of BCVI on repeat CTA, stroke, and mortality. Logistic regression was performed to identify the effects of these factors on outcomes.

Results: 491 patients with 635 injured vessels (300 carotid, 335 vertebral arteries) were identified. 60% were male, mean age was 44 yrs, and median ISS was 18[11-25]. Overall, 18% had multiple-vessel injuries, 16% had bilateral vessel injuries, and 3% had multiple injuries on the same side. The overall rates of progression to higher-grade injuries, stroke, and mortality were 23%, 7.7%, and 8.8%, respectively. On univariate and multivariable analyses, multiple and bilateral BCVIs were associated with progression to higher-grade injuries on repeat imaging, stroke, and mortality compared to the single vessel and unilateral injuries **(Table 1-2)**.

Conclusions: Half of BCVIs with multiple or bilateral injured vessels progress to higher grades on repeat CTA, with both factors independently associated with worse ultimate outcomes. These findings highlight the importance of incorporating the number and laterality of injured vessels in clinical decision-making and in defining protocols for repeat imaging.

Bilateral vs. unilateral	**Bilateral** (N=79)	**Unilateral** (N=412)	***p***
Progress to Higher Grade	42%	19%	**<0.001**
Stroke	10.1%	4.5%	**0.049**
Mortality	11.4%	4.6%	**0.017**
Multiple vs. Single	**Multiple** (N=89)	**Single** (N=402)	***p***
Progress to Higher Grade	45%	18%	**0.001**
Stroke	9%	3.7%	**0.045**
Mortality	10%	4.7%	**0.047**

Table 1 - Univariate Analysis of Outcomes Among Study Groups

Bilateral vs. unilateral	**aOR**	**95% CI**	***p***
Progress to Higher Grade	2.685	1.52-4.73	**<0.001**
Stroke	2.548	1.06-6.11	**0.036**
Mortality	3.288	1.38-7.82	**0.007**
Multiple vs. Single	**aOR**	**95% CI**	***p***
Progress to Higher Grade	3.308	1.93-5.67	**<0.001**
Stroke	2.811	1.13-7.012	**0.027**
Mortality	2.960	1.24-7.041	**0.014**

Table 2 - Multivariable Regression Analysis of Outcomes Among Study Groups

Scientific Session VII

Paper #45
January 12, 2024
9:15 am

SAVING LIMBS AND LIVES: A NOVEL PERCUTANEOUS VESSEL OCCLUSION DEVICE TO COMBAT JUNCTIONAL HEMORRHAGE IN TRAUMA

Bobby Zhang, MD, Beau Prey, MD, Jace Franko, MD, Jeffrey Conner, MD, Hannah Palmerton, Grace Pak, MD, Raanan Miller, PhD, Arnold Miller, MD, John Dorsch, DO, Erik Roedel, MD, Eric Raschke, MD, Jason Bingham, MD, Michael Lallemand, MD*
Madigan Army Medical Center

Presenter: Beau Prey, MD

Discussant: Madhu Subramanian, MD – Johns Hopkins Hospital

Objectives: Junctional hemorrhage remains a challenging injury pattern with high rates of morbidity and mortality. Current available junctional hemorrhage control devices have limited proven benefit. We conducted a feasibility study in a swine model to evaluate the Amsel SCureTO ™ regarding percutaneous access of a targeted vessel, ability to control distal hemorrhage, restoration of flow, and removal of the device without further surgical intervention.

Methods: We tested the device in a swine hybrid trauma model targeting the carotid and femoral arteries. We deployed the SCureTO percutaneously to transfix the femoral arteries with angiographic confirmation of occlusion. Next, we performed a partial transection injury to the carotid artery and controlled hemorrhage with the SCureTO under direct visualization. The injury was repaired with a shunt and confirmed by angiogram. All devices were removed, and vessel patency and lack of bleeding at the occlusion sites were confirmed with angiography.

Results: A total of 12 SCureTOs were tested in 5 swine. 7 (58%) targeted the femoral artery (4.5±1.0mm diameter) while 5 (42%) targeted the carotid artery (4.7±0.7mm diameter). 10 (83%) of SCureTOs completely transfixed and occluded the target vessel while 1 (8%) provided full occlusion with manipulation and 1 partially occluded the vessel. Average time to placement was 54.3±21.5 seconds. All devices were removed without surgical intervention and vessels remained patent without bleeding.

Conclusions: In this feasibility study, we demonstrated successful percutaneous and open deployment to achieve complete vessel occlusion, control of hemorrhage, and device removal with restoration of flow without further surgical intervention. The SCureTO has the potential to provide a solution to the management of junctional non-compressible hemorrhage. Further development and study to refine the device is in progress.

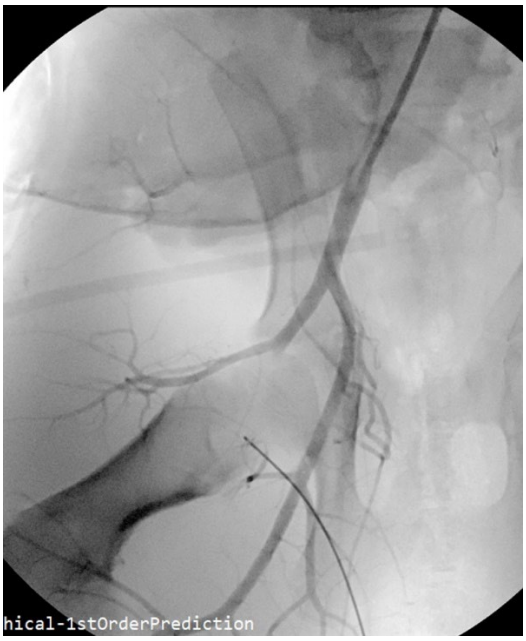


Figure 1. Angiography Demonstrating Complete Occlusion of Femoral Artery with SCureTOâ„¢ Device

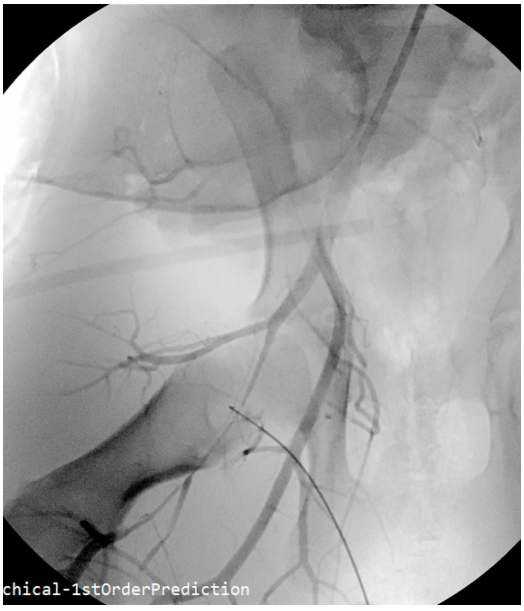


Figure 2. Angiography Demonstrating Restoration of Flow with Release of Clamps

Scientific Session VII

Scientific Session Paper #46
January 12, 2024
9:30 am

PROLONGED HOURLY NEURO EXAMS ARE ASSOCIATED WITH INCREASED DELIRIUM AND NO DISCERNIBLE BENEFIT IN MILD/MODERATE GERIATRIC TBI

Ricardo A Fonseca, Drew Del Toro, MD, Leonardo Diaz, MD, Melissa Canas, MD, Hussain Afzal, MD, Alejandro De Filippis, MD, Jose Aldana, MD, Aaron Day, RN, Jennifer McCarthy, EMTP, Kristin Stansfiled, EMTP, Mark Hoofnagle, MD, PhD*, Grant V. Bochicchio, MD, MPH*, Jennifer Leonard, MD, PhD*
Washington University in Saint Louis

Presenter: Ricardo A Fonseca

Discussant: Joseph Posluszny, MD – University Hospitals

Objectives: Serial Neurological Examination (NE) is the current standard of care for managing patients with acute TBI. There are currently no widely accepted guidelines for the frequency of NE. Disruptions to the sleep-wake cycle can lead to an increased rate of delirium. We hypothesized that geriatric TBI patients undergoing hourly (Q1) NE for prolonged periods would have an increased incidence of delirium without any direct benefit.

Methods: We included patients (>65y) with mild/moderate TBI, AIS ≤2 in any other anatomical region, admitted to the ICU with serial NE from 2019-2020. Cohorts were stratified by the duration of exposure to continuous Q1-NE, into Prolonged (≥24h) and Not Prolonged (<24h). We evaluated delirium by Confusion Assessment Method (CAM-ICU), radiological progression from baseline images, neurological deterioration (focal neurological deficit, abnormal pupillary exam, or GCS decrease >2), and neurosurgical procedures.

Results: A total of 255 patients with a mean age of 79 were included. No differences were found in demographics. The prolonged Q1-NE group (29.4%) had higher ISS with similar AIS Head, significantly higher delirium rate [61% vs 35%, p<.001], and longer Hospital/ICU length of stay when compared to the Not Prolonged Q1-NE group. No neurosurgical procedure was found to be performed emergently as a result of findings on NE. Multivariate analysis demonstrated that prolonged Q1-NE was the only independent risk factor associated with a 2.7-fold increase in delirium rate. The Number Needed to Harm for prolonged Q1-NE was 4.

Conclusions: Geriatric patients with mild/moderate TBI exposed to Q1-NE for periods longer than 24h had nearly a 3-fold increase in ICU-Delirium rate. One out of five patients exposed to prolonged Q1-NE is harmed by the development of delirium. No patients were found to directly benefit as a result of more frequent neurological examinations.

Outcomes

	Total *n= 255*	Prolonged Q1-NE (≥24h) *n=75 (29%)*	Not-Prolonged Q1-NE *n=180 (71%)*	*p-value*
Delirium (CAM-ICU +)	109 *(42.7%)*	**46 *(61.3%)***	63 *(35%)*	***<0.001***
Time from Initial NE Start to CAM+	*26h:02m*	*24h:21m*	*27h:12m*	
LOS *(±SD)*	6.9 *(6.5)*	**9.7 *(8.7)***	5.7 *(4.9)*	***<0.001***
ICU Days *(±SD)*	3.4 *(2.9)*	**4.6 *(3.8)***	*2.8* (2.3)	***<0.001***
Use of Mechanical Vent.	15 *(5.9%)*	**9 *(12%)***	*6* (3.3%)	***0.007***
Ventilator Days *(±SD)*	4.5 *(5)*	4 *(3.6)*	5.4 *(7.6)*	*0.828*
Mortality	13 *(5.1%)*	5 *(6.7%)*	8 *(4.4%)*	*0.462*
Discharge Disposition				***0.034***
Home	122 *(47.8%)*	26 *(35.1%)*	96 *(53%)*	
Not Home	120 *(32.5%)*	**43 *(58.1%)***	77 *(42.5%)*	

Outcomes

Logistic Regression: Risk Factors for Delirium in Geriatric Mild/Moderate TBI

	OR	*p-value*	95% C.I *Lower*	*Upper*
Age	1.012	0.494	0.977	1.049
Female Gender	1.247	0.434	0.717	2.167
mFI-5 Score	2.063	0.249	0.603	7.057
Beers Criteria Med	1.067	0.826	0.6	1.898
Trauma Mechanism	0.719	0.416	0.325	1.59
AIS Head Score	1.034	0.796	0.802	1.333
ISS	1.024	0.364	0.973	1.076
IPH (BIG 1-2-3)	1.322	0.07	0.978	1.786
Prolonged Q1-NE	**2.685**	**0.002**	1.454	4.96
Radiological Progression	1.455	0.439	0.563	3.757
Neurological Deterioration	1.553	0.455	0.489	4.935

Logistic Regression with Delirium (CAM-ICU+) as outcome

Scientific Session VII

Paper #47
January 12, 2024
9:45 am

THE IMPACT OF POST-OPERATIVE ENTERAL NUTRITION ON DUODENAL INJURY OUTCOMES: A POST HOC ANALYSIS OF AN EAST MULTICENTER TRIAL

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Discussant: Michael C. Smith, MD – Vanderbilt University Medical Center

Objectives: Leak following surgical repair of traumatic duodenal injuries results in prolonged hospitalization and NPO course. Parenteral nutrition(PN) has known morbidity, however leak patients often have complex injuries and hospital courses resulting in barriers to oral diet or enteral nutrition(EN). We hypothesized EN only would be associated with 1)shorter duration until leak closure and 2)less infectious complications and shorter hospital length of stay(HLOS) compared to PN.

Methods: This was a post hoc analysis of a retrospective, multicenter study from 35 Level-1 trauma centers of patients >14 years old who had surgery for duodenal injuries(1/2010-12/2020) and endured postoperative leak. The study compared nutrition strategies: EN vs PN vs EN&PN using Chi-Square and Kruskal-Wallis tests; if significance was found pairwise comparison or Dunn's test were performed.

Results: There were 113 trauma patients with duodenal leak: 43 EN, 22 PN, and 48 EN&PN. Patients were mostly male(83.2%) with penetrating injuries(81.4%) and median age 28 years(IQR17). There was no difference in injury severity or critical illness among the 3 groups, however there was a trend toward more pancreatic injuries among PN groups(Table1). EN patients had less days NPO and until a regular diet(< 0.05,Table 2). Time until leak closure was less in EN vs EN&PN patients (7days[IQR14.5] vs 25.5[55.8],p=0.010). EN patients had less intra-abdominal abscesses, bacteremia, and days with drains than the EN&PN group(all,p<0.05). HLOS was shorter among EN patients vs PN groups (27days[23.5] vs45[66] vs45[31],p=0.001). When controlling for predictors of leak, regression analysis demonstrated EN was associated with less HLOS (Î²-23.2, 95%CI -39.3to -7.1,p=0.005).

Conclusions: Our results suggest EN is associated with shorter duration to leak closure in trauma patients with duodenal injuries and should be used whenever feasible.

Table 1. Demographics, Injury Mechanism and Severity Among Trauma Patients with Operative Duodenal Injuries Complicated by Duodenal Leak Stratified by Nutrition Strategy					
	All Duodenal Leak Patients n=113	**Enteral Nutrition (EN) n=43**	**Parenteral Nutrition (PN) n=22**	**EN&PN n=48**	**p-Value**
Age, (median [IQR])	28 (17)	27 (15)	28.5 (13)	27.5 (20.3)	0.934
Gender, male, (n [%])	94 (83.2%)	34 (79.1%)	16 (72.7%)	44 (91.7%)	0.095
BMI, (mean [SD])	27.9 (23.7-31.6)	28.1 (8.2)	29.7 (6.3)	27.8 (7)	0.343
Penetrating Mechanism	92 (81.4%)	33 (76.7%)	19 (86.4%)	40 (8.3%)	0.579
Systolic Blood Pressure, (median [IQR])	113 (94-134)	121 (24)	105 (42)	113 (45)	0.159
Heart Rate	98 (86-112)	100 (24)	101 (24)	97 (28)	0.399
ISS	24 (16-29)	25 (15)	18 (23)	24 (11)	0.974
Massive Transfusion Protocol	50 (44.2%)	16 (37.2%)	13 (59.1%)	21 (43.8%)	0.278
Duodenal Injury AAST Grade		2 (1)	3 (1)	3 (1)	0.173
Pancreatic Injury	44 (33.9%)	11 (25.6%)	12 (54.6%)	21 (43.8%)	0.051
Pancreatic Injury AAST Grade		2 (2)	2.5 (2)	2 (2)	0.692
Primary Repair Alone **Complex Repair with Adjunctive Measures**	43 (38.1%) 70 (61.9%)	21 (48.8%) 22 (51.2%)	8 (36.4%) 14 (63.6%)	14 (29.2%) 34 (70.8%)	0.153
EN: Enteral nutrition only, PN: Parenteral nutrition only, EN&PN: Enteral and Parenteral nutrition					

Table 1. Demographics, Injury Mechanism and Severity Among Trauma Patients with Operative Duodenal Injuries Complicated by Duodenal Leak Stratified by Nutrition Strategy

Table 2. Outcomes Among Trauma Patients with Operative Duodenal Injuries Complicated by Duodenal Leak Stratified by Nutrition Strategy					
	All Duodenal Leak Patients n=113	**Enteral Nutrition (EN) n=43**	**Parenteral Nutrition (PN) n=22**	**EN&PN n=48**	**p-Value**
Days without Nutrition (median, IQR)	4 (4)	4 (3)	4 (4)	4 (4)	0.901
Post-Op Day Nutrition Started	4 (4)	4 (3)	4 (3.5)	4 (4)	0.801
Days of Enteral Nutrition	18 (27.3)	18.5 (24.8)	-	18 (25.3)	0.529
Days of Intravenous Nutrition	30 (50)	-	45.5 (62.8)	17 (35.5)	**0.006**
Days NPO	23 (39.3)	9 (14.5)	39.5 (55.3)	29 (36)	**<0.001** EN to PN = **<0.001** EN&PN to EN = **0.009** EN&PN to PN = 0.658
Days to Regular Diet	29.5 (34)	18 (18)	33.5 (34)	39.5 (48.8)	**0.002** EN to PN = 0.057 EN&PN to EN = **0.001** EN&PN to PN = 1.000
AKI	43 (38.1%)	7 (16.3%)	12 (54.6%)	24 (50%)	**0.005** EN to PN = **0.022** EN&PN to EN = **0.019** EN&PN to PN = 0.924
Bacteremia or Fungemia	30 (26.5%)	5 (11.6%)	7 (31.8%)	18 (37.5%)	**0.017** EN to PN = 0.199 EN&PN to EN = **0.029** EN&PN to PN = 0.848
Abdominal Abscess	76 (67.3%)	23(53.5%)	14 (63.6%)	39 (81.3%)	**0.017** EN to PN = 0.605 EN&PN to EN = **0.027** EN&PN to PN = 0.391
Days with Drains	37.5 (43.3)	22 (30)	41.5 (24.5)	48 (42.5)	**0.020** EN to PN = 0.249 EN&PN to EN = **0.019** EN&PN to PN = 1.000
Feeding Tube Placement	76 (67.3%)	27 (62.8%)	9 (40.9%)	40 (83.3%)	**0.002** EN to PN = 0.157 EN&PN to EN = 0.095 EN&PN to PN = **0.003**
Days Until Leak Closure	14 (38)	7.0 (14.5)	15.0 (20.5)	25.5 (54.8)	**0.008** EN to PN = 0.094 EN&PN to EN = **0.010** EN&PN to PN = 1.000
ICU LOS	15 (28)	8 (16)	20 (26)	24 (34)	**0.004** EN to PN = 0.187 EN&PN to EN = **0.003** EN&PN to PN = 1.000
Ventilator Days	8 (18)	5 (9.5)	12.5 (19)	10.5 (23)	**0.024** EN to PN = 0.428 EN&PN to EN = **0.020** EN&PN to PN = 1.000
Hospital LOS	37.5 (31.7)	27 (23.5)	45 (66)	45 (31)	**0.001** EN to PN = **0.016** EN&PN to EN = **0.002** EN&PN to PN = 1.000
Mortality (n, %)	11 (9.7%)	5 (11.6%)	2 (9.1%)	4 (8.3%)	0.864

Table 2. Outcomes Among Trauma Patients with Operative Duodenal Injuries Complicated by Duodenal Leak Stratified by Nutrition Strategy

Scientific Session VII

Paper #48
January 12, 2024
10:00 am

USE OF AN INTEGRATED PULMONARY INDEX PATHWAY DECREASED UNPLANNED ICU ADMISSIONS IN ELDERLY PATIENTS WITH RIB FRACTURES

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Presenter: Nicholas Davis, MD

Discussant: David Hampton, MD, Meng – University of Chicago

Objectives: Unplanned ICU admission (UIA) is an ACS Trauma Quality Improvement Program benchmark that is associated with increased morbidity, mortality, and length of stay (LOS). Elderly patients with multiple rib fractures are at increased risk of respiratory failure. The Integrated Pulmonary Index (IPI) assesses respiratory compromise by incorporating SpO_2, respiratory rate, pulse, and end tidal CO_2 to yield an integer between 1-10 (worst-best). We hypothesized that IPI monitoring would decrease UIA in elderly trauma patients with rib fractures.

Methods: Elderly (> 65 y/o) trauma inpatients admitted to a Level 1 trauma center 1/2020-2/2023 were retrospectively studied while trauma ward IPI monitoring was being introduced. Patients with >4 rib fractures (or > 2 with history of COPD) were eligible for IPI and were compared to a group of chest AIS 3 (> 3 rib fractures) patients who received usual care. Nurses contacted the surgeon for IPI < 7 or a decrease in IPI of > 2. Patient intervention was left to the discretion of the provider. Demographic, injury severity score (ISS), LOS, mortality, and UIA information was recorded. Statistical analysis was performed using Chi-square and Student t-test, with $p < 0.05$ considered significant.

Results: A total of 108 patients received IPI monitoring and were compared to 206 patients who did not. The IPI cohort was comparable to the non-IPI cohort in terms of age, % male, ISS, mortality, and overall LOS (Table 1). A greater proportion of non-IPI patients were initially admitted to the ICU (71.8% vs 60.2%, p=0.04). None of the patients monitored with IPI had UIA compared to 9 of the non-IPI group (p=0.032). The UIA resulted in 37 extra ICU days, 4 (44%) intubations, and 3 (33%) deaths.

Conclusions: The IPI is an easy to set up tool with minimal to no risk and was associated with dramatically reduced UIA in elderly patients with multiple rib fractures.

TABLE 1

Parameter	Non-IPI	IPI	p-value *
Number Subjects	206	108	-
ISS (mean ± SD)	14.0 ± 6.2	13.1 ± 6.1	0.220
Age (mean ± SD)	77.1 ± 8.5	78.9 ± 9.0	0.082
% Male	56.3%	57.4%	0.627
% Initial ICU Admit	71.8%	60.2%	0.042
LOS (mean ± SD)	6.4 ± 6.7	5.6 ± 4.2	0.260
Mortality (N, %)	4 (1.9%)	1 (0.9%)	0.665
Unplanned ICU Admit (UIA, N, %)	9 (4.4%)	0 (0%)	0.030
UIA Mortality	*3 (33%)*	*0*	
UIA % Intubated	*4 (44.4%)*	*0*	
UIA Days (range)	*37 (1-7 days)*	*0*	

* Fishers Exact Chi-square or t-test comparing non-IPI to IPI groups

Table 1