Poster #1

IMPACT OF TRANSFUSING PACKED RED BLOOD CELLS THROUGH A RAPID INFUSER ON POTASSIUM LEVELS

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Introduction: Hyperkalemia may be associated with transfusion of packed red blood in trauma patients. Currently available rapid infusers have the capability of infusing blood up to 500 ml/minute. To our knowledge, no study has evaluated mechanical hemolysis as a possible source of hyperkalemia due to the rate of infusion in trauma patients. The purpose of this study is to determine if high rates of blood transfusion impacts potassium levels in the blood.

Methods: Two baseline samples were obtained to measure potassium and hemolysis scores in 12 units of expired blood prior to infusion. This expired blood was then infused via the Belmont® Rapid Infuser into collection bags at varying rates of infusion (50 ml/min, 100 ml/min, 250 ml/min, 500 ml/min) utilizing different catheter sizes (18 gauge catheter, 16 gauge catheter, and cordis catheter). Two post infusion blood samples were collected and tested for potassium and hemolysis scores and compared to pre-infusion values. This process was then repeated with blood less than 14 days old (fresh blood). Samples were analyzed on an Abbott Architect c8000 autoanalyzer.

Results: The potassium levels of the two samples taken from each unit prior to infusion (average difference 0.245) and after infusion (average difference 0.08) correlated well. There was no difference in potassium levels pre and post infusion at any rate of infusion even after accounting for catheter size and age of blood (See table 1). The median potassium of the fresh blood was 5.025 prior to infusion and 4.875 after infusion. The median potassium level of the expired blood was 16.05 prior to infusion and 16.4 post infusion. There was no significant difference in the hemolysis scores between the pre-infusion and post-infusion samples. The expired blood had higher hemolysis scores compared to the fresh blood.

Conclusion: The hyperkalemia in trauma patients undergoing massive transfusions is not a result of mechanical hemolysis from the high rates of blood infusion. Rate of blood administration should be determined by patient's volume status and not concern for causing hyperkalemia.

Poster #2

OVER-TRIAGE WITH BLOOD FOR SUSPECTED HEMORRHAGE IS NOT ASSOCIATED WITH WORSE CLINICAL OUTCOMES

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Introduction: For trauma patients in hemorrhagic shock, delayed blood transfusion can lead to higher mortality, while unnecessary transfusion has been associated with worse clinical outcomes. We evaluated patient outcomes after early, small volume blood transfusion in the setting of presumed hemorrhagic shock. We hypothesized that over-triage with even small amounts of blood would be associated with a higher risk of complications.

Methods: Retrospective review of trauma patients admitted to a Level 1 trauma center between 2016 and February 2021. Data on red blood cell (RBC) units (U) transfused and massive transfusion protocol (MTP) activation were collected. Patients predicted to require MTP who survived ≥72 hours were categorized according to units of RBCs transfused in the first 24h: 0, 1-3, 4-9, ≥10U. Patients that received whole blood were excluded. A Cox regression model stratified by dichotomized ISS and adjusted for blunt injury mechanism and initial pulse >120bpm was used to estimate hazard ratios (HRs) for the outcomes of interest.

Results: Of the 22,998 trauma patients admitted during the study period, 8,347 were included. Of these, MTP was activated in 834/8347 (9.9%): 18% (154/834) received 0U, 28% (234/834) 1-3U, 34% (285/834) 4-9U and 19% (161/834) ≥10U of RBCs. Mean ISS increased with each category of RBC transfusion. There was no significant difference in the risk of acute kidney injury (AKI), acute respiratory distress syndrome (ARDS), infectious complications, cardiac arrest, venous thromboembolic events or stroke for patients receiving 1-3U of RBCs compared to the 0U or 4-9U groups ($p>.05$). Compared to those receiving ≥10U, the 1-3U group had a significantly lower risk of AKI (HR 0.22, 95% CI 0.09-0.53), ARDS (HR 0.12, 95% CI 0.02-0.97); and cardiac arrest (HR 0.17, 95% CI 0.05-0.61).

Conclusion: Early empiric blood transfusion for presumed hemorrhagic shock may subject patients to over-triage with blood. Among patients meeting current clinical triggers for massive transfusion, receiving 1-3 units of allogeneic blood is not associated with worse outcomes.

Poster #3

A COMPARISON OF WHOLE BLOOD VERSUS COMPONENT THERAPY IN CIVILIAN TRAUMA PATIENTS

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Introduction: Despite promising data in the military setting, civilian studies comparing whole blood (WB) and component therapy (CT) are limited. Furthermore, data regarding the use of WB in massively transfused patients are also limited. The purpose of this study was to compare outcomes in trauma patients before and after implementation of a WB program at a civilian trauma center. We hypothesized that patients receiving WB would have lower mortality and receive less blood products.

Methods: We performed a single center cohort study of adult male trauma patients who received blood products upon admission to our ACS-verified, urban, level 1 trauma center. Patients who received initial resuscitation with two units of WB followed by CT were prospectively collected and compared to two years of historic control patients who received only CT blood products. Primary outcomes included mortality as well as total blood product cost and volume transfused (including WB, packed red cells, plasma, platelets). Secondary outcomes were ICU and hospital length of stay (LOS).

Results: We identified 295 patients that met inclusion criteria (90 WB and 205 CT). Patients who received CT were older (45 vs 39 years old, p=0.005), more Caucasian (79% vs 67% p=0.03) and had more severe extremity injuries (AIS 2±1.6 vs 1.5±1.4, p=0.02). There were no other significant differences in patient demographics or injury patterns. Outcomes in the table.

	CT (n=205)	WB (n=90)	P-Value
Mortality	38 (19%)	16 (18%)	0.88
Hospital LOS (days)	15 ± 17	15 ± 20	0.94
ICU LOS (days)	9 ± 13	8 ± 9	0.39
Transfusion volume (liters)	5.5 ± 9.4	4.6 ± 5.7	0.43
Cost	$3,407±$5,522	$2,798±$3,313	0.33

Analysis of a subset of patients who received massive transfusion (n=140) also showed no differences in mortality (21% CT vs 27% WB, p=0.47), cost ($5,643±7163 CT vs $4,703±4,030 WB, p=0.43), or transfusion volume (9.4±12.4 L CT vs 8.0±7.0 L WB, p=0.51).

Conclusion: Initial resuscitation of trauma patients with two units of WB is not associated with reduced mortality or blood product cost and utilization. Future studies should evaluate the use of higher volumes of WB in civilian trauma patients.

Poster #4

A MULTICENTER STUDY ON MASSIVE BLOOD TRANSFUSION THRESHOLDS AMONG SEVERELY INJURED PATIENTS

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The COVID-19 pandemic has created a donation shortage of blood products. Massive transfusion protocols (MTP) for severe hemorrhage can rapidly reduce institutional and regional blood availability. The purpose of this study is to provide data-driven guidance for the use and triage of the MTP when the blood supply is severely limited.

This is a retrospective cohort study of 47 Level I and II trauma centers (TC) within a single health system whose patients received MTP from 2017-2019. All TC used a unifying MTP protocol for balanced blood product transfusions. The primary outcome was mortality as a function of volume of blood transfused and age. Hemoglobin thresholds and measures of futility were also estimated. Risk adjusted analyses were performed using multivariable and hierarchical regression to account for confounders and hospital variations.

MTP volume thresholds for three age cohorts were identified: 60 units for ages 16-30, 48 units for ages 31-55, and 24 units for > 55 years. For all age groups, the range of mortality less than the transfusion threshold was 30-36%, but doubled to 67-77% when the threshold was exceeded. Hemoglobin concentration differences relative to survival were clinically insignificant. Prehospital measures of futility were pre-hospital cardiac arrest and non-reactive pupils. In-hospital risk factors of futility were midline shift on brain CT and cardio-pulmonary arrest.

MTP practices under blood shortage conditions, such as the current COVID 19 pandemic, could sustain blood availability by following thresholds for MTP use according to age group.

Poster #5

DEFINING THE SUPERMASSIVE TRANSFUSION IN US AND COALITION FORCES DURING COMBAT OPERATIONS IN AFGHANISTAN AND IRAQ

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Introduction: Hemorrhage is the leading cause of potentially preventable death on the battlefield. After hemorrhage control, resuscitation with blood products is essential to restore circulating volume, repay the oxygen debt, and prevent coagulopathy. While massive transfusion (MT) occurs frequently after major trauma, the characteristics of the subset of casualties requiring super massive transfusion (SMT) and thus mobilization of additional resources remains unclear. We seek to describe this population.

Methods: This is a secondary analysis of a previously described dataset from the Department of Defense Trauma Registry. In this analysis, we isolated US and Coalition casualties that received at least 1 unit of packed red cells (PRBC) or whole blood (WB). To describe the SMT recipients, we included those patients receiving the top quartile of total products administered within the first 24 hours following arrival to a military treatment facility.

Results: There were 28,950 casualties from 01 January 2007 through 17 March 2020, of which 10,172 were US military or Coalition forces. Of these, 2,608 received at least one unit of packed red blood cells or whole blood and met inclusion for this analysis. The median number of units transfused was 8 (IQR 4-18). Using a threshold of 18, our SMT group had 666 casualties. The median age was 24 in both groups with similar for US military (Baseline 81.6% versus SMT 79.7%, $p=0.269$). Most were battle injuries (92.5% versus 95.9%, $p=0.002$) and injured by explosives (68.6% versus 84.9%, $p<0.001$). The median ISS was 18 versus 27 in the SMT cohort ($p<0.001$). Survival to discharge was 93.3% in the baseline cohort versus 85.8% in the SMT cohort ($p<0.001$). Vital signs and laboratory values were worse in the SMT group. The SMT cohort received larger quantities of all blood products including WB, PRBCs, platelets, cryoprecipitate, and fresh frozen plasma. On an analysis of associated injury patterns, the SMT cohort was more likely to have injuries to the thorax (Odd Ratio 1.55), abdomen (2.39), extremities (4.93), and skin (2.70).

Conclusions: Compared to all other PRBC and WB recipients, SMT patients experienced more severe injury patterns, ED vital sign derangements, and mortality. More data is needed to define this population early in their clinical course for early identification to facilitate rapid resource mobilization.

Poster #6

RELATIONSHIP OF POST-RESUSCITATION HEMOGLOBIN TO FUTURE BLOOD TRANSFUSION NEEDS

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Introduction: Goal post-resuscitation (PR) hemoglobin (Hgb) remains unclear in the 24 hours (h) following injury. Although guidance exists for stable all-comer critically ill patients (Hgb>=7), no clear criteria exists in the first 24h for injured patients. With empiric balanced resuscitation protocols, concerns about 'over-transfusion' exist given initial PR Hgbs of 9-11g/dL. This study investigates the relationship between PR Hgb & subsequent likelihood of packed red blood cell (PRBC) transfusion out to 24h.

Methods: Adult highest-level trauma activations enrolled in a prospective cohort study who were alive at 6h & had a PR Hgb were included. PR Hgb was defined as the Hgb 6h from initial presentation. Demographics, injury characteristics, vital signs, lab data, and complications were collected. Those receiving & not receiving PRBC transfusion at 6-24h were compared.

Results: 282 patients were alive at 6h (median ISS 26, age 38y, 70% blunt). Between 6-24h, 32% were transfused PRBCs. 28-day survival was 87%. Likelihood of PR PRBC transfusion was inversely correlated to 6h Hgb reaching at least a 50% chance if Hgb<11g/dL (Fig A). There was no trend difference by mechanism. Median PR PRBC units(u) transfused was 2 if Hgb<11g/dL vs. 0 for Hgb>11g/dL (p<0.001), with 24% receiving >4u if Hgb<11g/dL (Fig B).

Conclusion: Applying transfusion criteria of Hgb<7g/dL is likely not appropriate in the 24h post-injury. Initial PR transfusion practices should be based upon physiology in combination with a higher Hgb trigger threshold.

Fig A. Likelihood of Transfusion by Hbg Group

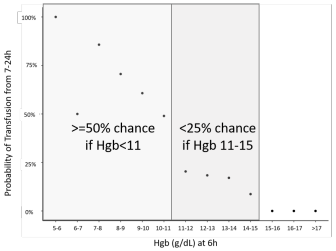
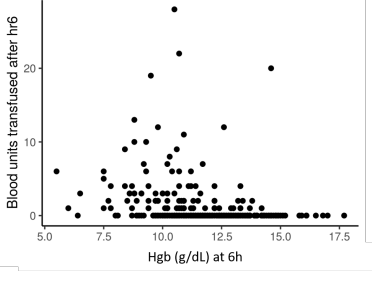


Fig B. Units Transfused per patient



Poster #7

RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA IMPROVES SURVIVAL IN HEMORRHAGIC SHOCK

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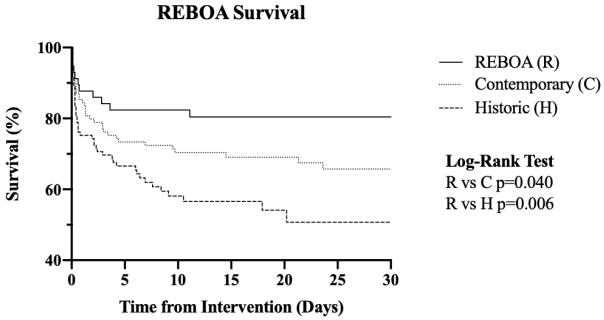
Objective: Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is controversial as a hemorrhage control adjunct due to lack of data with a suitable control group. We aimed to determine outcomes of trauma patients in shock undergoing REBOA versus no-REBOA.

Methods: This single-center, retrospective, matched cohort study analyzed patients >16 years in hemorrhagic shock without cardiac arrest (2000-2019). REBOA (R; 2015-2019) patients were propensity matched 2:1 to historic (H; 2000-2012) and contemporary (C; 2013-2019) groups. In-hospital mortality and 30-day survival were analyzed using chi-squared and log rank testing, respectively.

Results: A total of 39,390 patients were included (R=57, C=25,410, H=13,923). Propensity scores were assigned using age, race, mechanism, lowest systolic blood pressure, lowest Glasgow Coma Score (GCS), and body region Abbreviated Injury Scale scores to generate matched groups (R=57, C=114, H=114). Mortality was significantly lower in the REBOA group (19.3%) compared to the contemporary (35.1%; p=0.024) and historic (44.7%; p=0.001) groups. 30-day survival was significantly higher in the REBOA versus no-REBOA groups.

Conclusion: In a high-volume center where its use is part of a coordinated hemorrhage control strategy, REBOA improves survival in patients with noncompressible torso hemorrhage.



Poster #8

TYPE O BLOOD IS A RISK FACTOR FOR SYSTEMIC HYPERFIBRINOLYSIS AND MASSIVE TRANSFUSION

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Introduction: Von Willebrand factor (VWF) levels are 25–35% lower in blood type O. VWF's functions include attachment to platelets and binding FVIII. We hypothesize that patients with type O are more likely to present with trauma-induced coagulopathy.

Methods: Adult trauma activations with known blood type in a Level I trauma center with field SBP<90mmHg were studied. The relationships of blood group O vs. non-O to PT/INR, PTT, fibrinogen, D-dimer, r-TEG, and massive transfusion (MT, >4U RBC or ≥1U RBC + death/1hr postinjury), ventilator-free days, and mortality were adjusted for confounders (univariately associated with Type-O with $p<0.25$). Fibrinolysis in the setting of hypotension was defined as (Hyperfibrinolysis (HF) LY30>3%; Shutdown (SD) LY30<0.9%). A subset of patients (n=212, 79.1%) with available plasma had VWF activity quantified on a STAGO apparatus.

Results: 268 patients (42.9% Type-O, 57.1% blunt injury, median age 33.9 years, 78.7% M, and median NISS=25) met criteria. Type-O patients had lower mean VWF activity (222.4±8.072% vs. 249.2±9.748%, $p=0.01$). There were no differences in risk factors between groups, except NISS (O: 27; Non-O: 22, $p=0.14$) and blunt mechanism (O: 64.3%; Non-O: 51.6%, $p=0.04$). After adjustment for NISS and blunt mechanism, Type-O had higher odds of HF (OR: 1.94, 95%CI:1.09-3.47; Pearson GOF test, $p=0.56$) and increased odds of MT (OR: 3.02, 95%CI:1.22-7.49; AUROC: 0.82; 95%CI:0.72-0.92).

Conclusions: Type-O patients with injury-related hypotension are at higher risk for HF and MT after adjustment for NISS and mechanism. This suggests that patients with Type-O and/or receiving Type-O should be monitored closely for HF to attenuate their increased risk of MT.

Poster #9

WHOLE BLOOD IMPACT ON A TRAUMA CENTER: DECREASED TRANSFUSIONS DESPITE INCREASED PATIENT VOLUME

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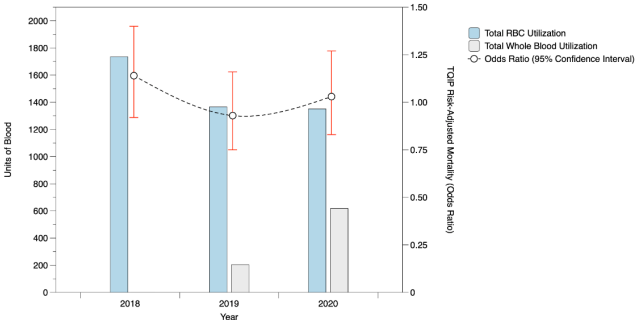
Introduction: The number of civilian trauma centers using whole blood (WB) for resuscitation is increasing. While improvement in patient outcomes has been described, the impact of WB on overall blood product utilization is relatively unknown. We sought to evaluate the global changes to our trauma program after the introduction of WB to our initial trauma resuscitations.

Methods: WB was introduced at our center in 2019. Blood bank records were used to measure service level trends in annual blood product utilization while TQIP was utilized to identify mortality and complication rates before and after WB implementation.

Results: From 2018-2020, there were 15,162 trauma activations with 11,527 admissions, both increasing annually. Risk adjusted mortality decreased over the study period (OR 1.14 vs. 1.03 for pre- and post-WB, respectively). The median number of RBCs (4 [2,10] vs 3 [2,6]) and FFP (4 [2-9] vs 3 [2,6]) transfused within 4 hours to patients with hemorrhagic shock declined from 2018 to 2020, while the median units of WB increased from 0 [0,0] to 4 [2,4]. The total number of RBCs transfused to trauma patients declined every year from 2018 (1735 units) to 2020 (1351 units). Over the same period, the number of units of WB increased (0 to 618). The average combined number of units of RBCs and WB per admission fell from 0.48 to 0.47 from 2018 to 2020.

Conclusion: Implementation of a WB resuscitation program for trauma corresponded with an increase in patient volume but decrease in overall blood utilization at our trauma center.



Poster #10

WHOLE BLOOD IN MASSIVE TRANSFUSION PROTOCOL LOWERS BLOOD USE WITH MARGINAL INCREASE IN COST

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Introduction: A limitation to use of whole blood (WB) in civilian trauma is increased unit cost. However, WB may decrease overall blood product requirements. We compared the cost of blood products and outcome before and after adding WB to our massive transfusion protocol (MTP).

Methods: Retrospective review of patients receiving MTP from 10/2018-05/2020. Equal cohorts evaluated comparing patients receiving components only (COMP-MTP) and whole blood plus components (WB-MTP). Costs obtained from the blood bank. Repeated measures ANOVA used to compare patients on MTP type and length of stay to account for survival bias. Piecewise Cox regression used to estimate mortality.

Results: 229 patients were included (141 COMP-MTP, 88 WB-MTP). WB-MTP received significantly fewer units of RBCs (5.6±0.8 vs. 9.1±1.0; p=0.04), FFP (5.2±0.6 vs. 8.1±0.8; p=0.03), and platelets (0.5±0.1 vs. 1.3±0.1; p=0.03) compared to COMP-MTP within 3 hours. No differences in product utilization from 3-24 hours or mortality rates. Total costs were higher for WB-MTP compared to COMP-MTP at 24 hours (Table 1)

Conclusion: Adding WB to the MTP decreased early blood product utilization with minimal increase in average cost of all transfused products.

Table 1: Comparison of Mean Blood Product Acquisition Costs Between Patients with and without Whole Blood in Massive Transfusion.

		COMP-MTP (n = 141)	WB-MTP (n = 88)
Whole Blood	24 Hour	$0	$2,125.00
	7 Day	$0	$2,125.00
Packed Red Blood	24 Hour	$2,292.20	$1,343.18
Cells	7 Day	$2,740.43	$1,647.73
Fresh Frozen	24 Hour	$395.18	$245.91
Plasma	7 Day	$427.80	$270.00
Platelets	24 Hour	$964.54	$431.82
	7 Day	$1,138.30	$528.41
Total Product	24 Hour	$3,651.91	$4,145.91
Acquisition Costs	7 Day	$4,306.52	$4,571.14

*Adjusted for race, sex, severe traumatic brain injury, and Injury Severity Score

Poster #11

HYPERGLYCEMIA IN NON-DIABETIC ADULT TRAUMA PATIENTS IS ASSOCIATED WITH WORSE OUTCOMES THAN DIABETIC PATIENTS: AN ANALYSIS OF 95,770 PATIENTS

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Introduction: The adverse impact of acute hyperglycemia is well documented but its specific effects on non-diabetic trauma patients are unclear. The purpose of this study was to analyze the differential impact of hyperglycemia on outcomes between diabetic and non-diabetic trauma inpatients.

Methods*:* Adults admitted 2018-19 to 45 Level I/II trauma centers with ≥2 blood glucose tests (BGT) were analyzed. Diabetes status was determined from ICD-10, trauma registry and/or HbA1c >6.5. Patients with and without ≥1 hyperglycemic result >180 mg/dL were compared. Logistic regression examined the effects of hyperglycemia and diabetes on outcomes, adjusting for age, gender, ISS & BMI.

Results*:* There were 95,770 patients: male 54%, mean age 61, mean ISS 10, diabetic 21%. Patients with hyperglycemia had higher mortality and worse outcomes compared to those without hyperglycemia (Table). Non-diabetic hyperglycemic patients had the highest odds of mortality (Diabetic: aOR: 2.1, 95% CI: 1.7-2.7, Non-diabetics aOR: 7.5, 95% CI: 6.8-8.4).

Conclusions*:* Hyperglycemia is associated with increased odds of mortality in both diabetic and non-diabetic patients. Hyperglycemia during hospitalization in non-diabetics was associated with the worst outcomes and represents a potential opportunity for intervention in this high-risk group.

	Diabetic		**Non-Diabetic**	
	Hyperglycemic	**Not Hyperglycemic**	**Hyperglycemic**	**Not Hyperglycemic**
	n=14,724 (15%)	n=5,761 (6 %)	n=9,380 (10 %)	n=65,905 (69%)
ISS (mean score)	9.7*	8.6	16.2*	9.3
Age (mean years)	70.5*	71.2	58.2	58.5
Male (%)	50.9*	46.7	60.9*	54.7
LOS (mean days)	6.9*	4.4	11.4*	5.0
ICU stay (% yes)	40.2*	35.0	68.6*	35.1
Mortality (%)	3.9*	1.6	14.6*	1.1
Sepsis (%)	0.5*	0.1	1.0*	0.1

*Group differs statistically from not hyperglycemic patients with same diabetes status (ref.) at p<.05

Poster #12

ANTECEDENT TRAUMATIC INJURIES INDEPENDENTLY PREDICT HIGHER 90-DAY MORTALITY FOR PATIENTS ADMITTED TO THE ICU WITH SURGICAL SEPSIS

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Introduction: Patients admitted with traumatic injuries are at high risk for sepsis due to their acutely dysregulated immune responses, which can alter the severity of the septic insult. It is unclear how this additive insult changes the course of severe sepsis. The primary objective of this study was to compare in-house mortality between patients with and without antecedent trauma for those admitted to the surgical ICU (SICU) with sepsis.

Methods: All patients admitted to the SICU with a diagnosis of sepsis (Sepsis III) were reviewed at a single academic institution between 2014-2019 (n=1489). Demographics, comorbidities, and sepsis presentation were compared between patients with an acute, preceding traumatic injury (n=111) and those without (n=1378). The primary outcome was 90-day mortality; secondary outcomes included respiratory failure (RF), hospital length of stay (LOS) and discharge disposition. A Cox proportional hazards model was performed to calculate hazards ratios for predictors of 90-day mortality. A p value <0.05 was considered significant.

Results: The trauma cohort was younger (60.1 +/- 14.8 years vs. 56.8 +/- 20.0 years, p=0.03), more likely to be male (68.5% vs. 54.5%, p=0.004), and have less median comorbidities (Charlson Comorbidity Index 2 (0-4) vs 4 (2-6), $p<0.005$) compared to the non-trauma cohort. In-house mortality was significantly higher for the trauma cohort (30.6% vs 22.5%, p = 0.05). Compared to critically-ill patients without an antecedent trauma, the trauma cohort also exhibited higher median overall LOS (25 (12-40) days vs 19 (10-31) days, $p<0.005$), rates of RF (92.8% vs 70.5%, $p <0.005$), and were less likely to be discharged home (13.0% vs 28.8%, p = 0.03). Compared to the non-trauma cohort, trauma status was associated with an over two-fold increase in the Hazards ratio for 90-day mortality (HR: 2.23, 95th CI: 1.5-3.22, $p <0.005$), after adjusting for age, sex, medical comorbidities, obesity and SOFA score.

Conclusion: Our data suggests that traumatic injuries predispose patients to worse outcomes following sepsis, despite having favorable characteristics such as younger age, less medical comorbidities, and reduced SOFA scores. This suggests that the sepsis profile associated with trauma may be unique from other patients with surgical sepsis. Further data is needed to delineate specific risk factors that can assist with earlier identification and treatment for this cohort.

Poster #13

DELRIUM RISK IN GERIATRIC ARTHROPLASTY (DRIGHA). DEVELOPMENT AND VALIDATION OF A NOVEL SCORE USING NATIONAL DATA

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Jersey Shore Medical Center

Background: The incidence of delirium in geriatric patients after a hip arthroplasty has been reported up to 55%. In-hospital delirium results in prolonged hospital course and increase morbidity and mortality. The purpose of the study was to identify the risk factors and create a scoring system for the point of care physician to minimize the risk.

Methods: The National Surgical Improvement Program (NSQIP) database was accessed for the study. Included in the study were all geriatric patients age 65 years and older who underwent hip arthroplasty. First, the data were compared between the group who developed delirium and the group who did not develop delirium. Multivariable analysis was performed to identify the risk of delirium using all the available information including demography, timing of surgery, comorbidities and infective complications. Eighty percent of the data were used to develop the model and 20% data were used to validate the risk model. A Receiving Operating Characteristics (ROC) curve was created and Area Under the Curve (AUC) was calculated with 95% confidence interval (CI). A delirium risk in geriatric hip arthroplasty (DRIGHA) score was created from the β coefficient of the variables, multiplied by the factor 10, and rounded to the nearest whole number. All p values were two sided and a p value <0.01 was considered statistically significant.

Results: Out of 36,090 patients who qualified for the study, 9,980 (27.7%) patients developed in-hospital delirium. There were significant differences found on many variables in univariate analysis. Our risk model showed advanced age, male gender, prior history of delirium and dementia, certain comorbidities and lack of mobility after the surgery were associated with higher incidence of in-hospital delirium. The area AUC was 0.79 (95% CI, 0.79-0.80) means the model is good for predicting the delirium. Our DRIGHA score goes from 0-80 and the predictability of delirium goes from 6.5% to 99.9%.

Conclusion: The incidence of in-hospital delirium after hip arthroplasty was ~ 28%. Certain demography characteristics, comorbidities and infective complications were associated with higher risk of developing in-hospital delirium. DRIGHA score can be calculated at the bedside to identify the high-risk patients.

Poster #14

IMPACT OF EARLY MICROBIAL CULTURES IN TRAUMA PATIENTS ADMITTED TO THE ICU

Mehreen T. Kisat MD, MS; Patrick Shahan MD; Angela Gibson MD, PhD; Alexandra Lacey MD; Ann O'Rourke MD, MPH; Ban Zarzaur MD, MPH, FACS
University of Wisconsin School of Medicine and Public Health

Introduction: Sepsis is a common, life-threatening condition following trauma that is associated with high mortality. Early diagnosis and treatment of the underlying source of sepsis improves survival. However, the diagnosis of sepsis in trauma patients can be complicated by concomitant systemic inflammatory response secondary to tissue injury. The purpose of the study was to examine the rate at which microbial cultures are positive in trauma patients at presentation.

Methods: Adult (Age ≥ 16 years) patients with an Injury Severity Score (ISS) of ≥ 9 admitted to the Intensive Care Unit at a level I trauma center over a five-year period were included in a retrospective cohort. Demographic, clinical, injury-related characteristics, and results of all microbial cultures (urine, blood, bronchoalveolar lavage/tracheal aspirate) were abstracted. The primary outcome was fraction of patients where cultures were obtained (patients with cultures sent/all patients) on each day in the hospital. The secondary outcome was fraction of those cultures that yielded positive results (patients with positive culture/all patients with cultures sent). Comparisons between fractions over days were performed using the chi-square test.

Results: Of a total of 12,321 patients, 1,604 met the study criteria. The median age was 55 years and 71% of patients were male. The median ISS was 22. On day one, 66/1,604 patients (4%) were cultured and this rate increased to 113/1562 (7%) on day two ($p<0.001$). However, fraction of cultures positive was 49% (32/66) on day one and it decreased to 37% (42/113) on day two ($p=0.138$). Of the 38 positive cultures on day one, most patients (45%) had positive urine cultures (n=17), followed by bronchoalveolar lavage/tracheal aspirate (34%, n=13) and blood (18%, n=7).

Conclusion: Approximately half the cultures sent on the first day were positive in trauma patients admitted to the ICU. Early detection of sepsis in the setting of systemic inflammatory response is important because early treatment and source control may prevent mortality.

Poster #15

IMPROVING ENTERAL NUTRITION DELIVERY IN THE CRITICALLY ILL TRAUMA & SURGICAL POPULATION

Jason McCartt, MD; Kehaulani Backes, RD; Kyle Cunningham, MD; Ronald Sing, DO; Gaurav Sachdev, MD
Carolinas Medical Center

Introduction: Critically ill trauma and surgical patients often fail to achieve adequate enteral nutrition (EN) support. The Society of Critical Care Medicine (SCCM) and the American Society for Parenteral and Enteral Nutrition (ASPEN) jointly recommend that at least 80% of prescribed enteral nutrition therapy should be delivered. A review of our institution's historic performance demonstrated 65% delivery of prescribed EN. Nutrition delivery was improved to 72% of prescribed EN with implementation of a volume-based protocol, however, remained below recommended ASPEN guidelines. Implementation of an evidence-based multidisciplinary protocol has been shown to improve EN delivery in mostly non-surgical patients. An evidence-based multidisciplinary protocol was developed to enhance EN delivery in critically ill trauma and surgical patients. We identified delivery of EN percentage as a quality improvement metric and coupled the outcome to attending physician performance incentive. The protocol aimed to minimize perioperative fasting times, enhance delivery using a volume-based feeding protocol, increase post-pyloric access, minimize cessation of enteral feeding for intolerance, and education implementation. We hypothesized that implementation of this multidisciplinary nutrition enhancement protocol (EP) would result in improved delivery of prescribed EN.

Methods: Data were prospectively captured from the daily rounds and the electronic health record (EHR) and entered into our REDCap (Research Electronic Data Capture) database. Captured data included daily volume of tube feeds, type of tube feeds, reasons for inadequate delivery of EN, calculated daily delivery of EN, and nutritional requirement based on individual energy and protein needs using simplistic weight-based equations as recommended by ASPEN guidelines. The study compared patients prior to protocol (PP) with patients following implementation of the enhanced protocol (EP). The primary outcome was delivery of greater than 80% of prescribed EN kilocalories (kcal) in critically ill trauma and surgical patients. Institutional Review Board approval was obtained as a quality improvement initiative and the study was completed at an ACS-verified Level 1 trauma center. Inclusion criteria for the study consisted of patients aged > 18 years, admission to trauma or surgical ICU for > 72 hours, and hemodynamic stability to receive EN. Patients were excluded if they had undergone recent gastrointestinal procedure which would preclude enteral feedings. Data were analyzed using standard statistical methods. For continuous variables, comparisons were made between groups using Student's t-tests. For categorical variables, comparisons were made using χ^2. P-value < 0.05 was considered significant.

Results: We identified 2663 EN days prior to intervention and 2059 EN days following intervention between September 2016 and September 2020. The average percentage of nutrition delivered (based on 24-hr kcal requirements) improved following the enhanced protocol (75.3 PP vs 85.5% EP, $p < 0.01$). The primary outcome of patients receiving greater than 80% of nutrition goal also improved (52.7% PP vs 65.2% EP, $p < 0.01$). The average percentage of nutrition delivered was improved in both surgical (69.9% PP vs 78.7% EP, $p <0.01$) and trauma (78.2% PP vs 87.3 % EP, $p <0.01$) populations. For the trauma patients that failed to meet adequate daily caloric intake, perioperative cessation of feeds, gastrointestinal intolerance, and failure to adhere to protocol were the most significant contributors.

Conclusion: Implementation of a multidisciplinary, focused nutrition-enhancement protocol improved nutrition delivery to critically ill trauma and surgical patients.

	Prior to Protocol	Enhanced Protocol	Difference	p-Value
All patients' average percentage of prescribed EN delivered (%)	75.3	85.5	10.2	<0.01
Percentage of patients receiving > 80% of prescribed EN (%)	52.7	65.2	12.5	<0.01
Trauma patients' average percentage of prescribed EN delivered (%)	78.2	87.3	9.1	<0.01
Surgical patients' average percentage of prescribed EN delivered (%)	69.9	78.7	8.8	<0.01

Poster #16

LATE TRACHEOSTOMY WHEN NEW YORK CITY WAS THE COVID-19 EPICENTER: WAS IT WORTH THE WAIT?

Kiah Andrews BA; Anna Liveris MD; Dalia Alqunaibit MD; Edward Chao MD; Srinivas H Reddy MD; Sheldon Teperman MD; Melvin E Stone Jr MD
Jacobi Medical Center

Introduction: During New York City's (NYC) time as the world's COVID-19 epicenter, there was unclear guidance on when to perform tracheostomy for COVID+ patients. We hypothesized that early tracheostomy (≤14 days) would demonstrate improvement in clinical outcomes over late tracheostomy.

Methods: We conducted a retrospective chart review of all COVID+ tracheostomies performed between March 6-June 9 2020 in patients ≥18 years at the 11 acute care hospitals comprising the NYC municipal hospital system. 30-day mortality, ICU LOS, and 30-day decannulation were compared between early and late tracheostomy using proportional hazards regression.

Results: There were 49 early (mean 9.6±3.6 days) and 154 late (26.3±8.5 days) tracheostomies with total mean age 59±12 years and no difference in mean Charlson Comorbidity Index (CCI), admission Sequential Organ Failure Assessment (SOFA) and median PaO2/FiO2 (P/F) ratio. There was no difference in mortality or complications between groups. After adjusting for age, CCI, SOFA score, P/F ratio, and ICU complications, patients with late tracheostomies were 63.5% less likely to be discharged at 5 weeks and 65.1% less likely to be decannulated in a 30-day postoperative observation period.

Conclusions: This study, the largest COVID+ tracheostomy series to date, suggests late tracheostomy may contribute to longer hospitalizations and delayed decannulation in critically-ill COVID-19 patients without improvement in mortality.

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Poster #17

OBESITY IS ASSOCIATED WITH INCREASED MORTALITY FOLLOWING ADMISSION TO THE ICU WITH SURGICAL SEPSIS

Anahita Jalilvand, MD PhD; Megan Ireland, B.S; Scott Strassel, PhD; Jon Wisler, MD
Ohio State University

Introduction: Many large studies have demonstrated a protective association between obesity and survival following sepsis. Given its association with surgical morbidity, the primary objective of this study was evaluating the association between obesity and mortality following admission to the surgical ICU (SICU) for patients with surgical sepsis.

Methods: All patients admitted to the SICU were reviewed from 2014-2019 at a single center and grouped into obese (OB; BMI $\geq$ 30 kg/m^2, n=810) and non-obese (NOB; BMI <30 kg/m^2, n=621). Exclusion criteria included BMI <18.5 kg/m^2 and SOFA <2. Baseline demographic, comorbidity and clinical data were compared between groups, including admission SOFA, vasopressor use and lactate. Respiratory failure (RF), renal replacement therapy (RRT), SICU length of stay (LOS), and 90-day mortality were compared. Multivariable regression analyses were used to model predictors of 90-day mortality, RF, RRT, and SICU LOS. P value <0.05 was considered significant.

Results: Age and racial composition were comparable between groups. The OB cohort were more likely to have type II diabetes (T2DM) (35.6% vs 21.4%, p <0.0005) and congestive heart failure (CHF) (10.1% vs 6.6%, p = 0.02) but less likely to present with moderate-severe liver disease (MS-LD) (5.6% vs 8.4%, p = 0.04). The median SOFA was not different between cohorts. OB patients had higher rates of RF (75.6% vs 67.5%, p=0.001), RRT (21.5% vs 11.6%, p<0.0005), and longer median SICU LOS (8 (3.5-17.5) days vs 6 (2.7-14.5) days, p=0.0003). 90-day mortality was higher in the OB cohort (33.8% vs 23.8%, p<0.0005). After controlling for age, sex, SOFA, CHF, T2DM, and MS-LD, obesity was associated with a 31% increase in 90-day mortality compared to NOB (HR: 1.3, 95th CI: 1.1-1.6) and was an independent predictor for RRT (OR: 2.3, 95th CI: 1.7-3.1), RF (OR 1.5, 95th CI: 1.1 – 1.9) and SICU LOS (β:1.8, 95th CI: 0.3-3.3).

Conclusion: Following admission to the SICU, obesity was associated with increased 90-day mortality, RRT, RF, and ICU LOS, after controlling for comorbidities and sepsis severity. This suggests that the obesity paradox may not be applicable within the context of surgical sepsis. Further studies are needed to elucidate the impact of obesity on sepsis-induced immune dysregulation and what implications it has on the management of critically-ill surgical patients.

Poster #18

ONE SIZE DOES NOT FIT ALL - SEX BIAS IN PHARMACOLOGIC VENOUS THROMBOEMBOLISM PROPHYLAXIS

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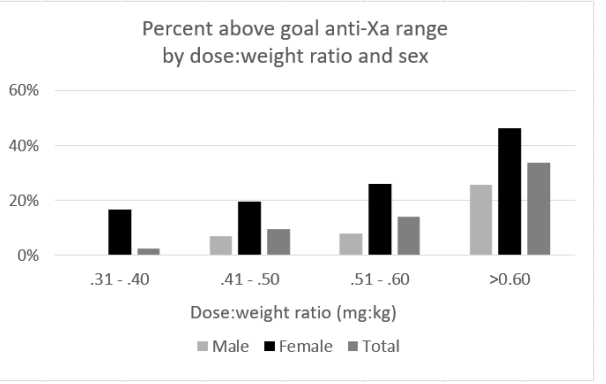
University of California San Diego

Introduction: Optimal dosing strategies for VTE prophylaxis in trauma patients remain unclear. Current dosing guidelines often include weight, age, and renal function, but do not consider sex. We hypothesized that additional patient factors influence optimal prophylactic dosing in trauma patients.

Methods: This is a retrospective review of patients admitted to a level 1 trauma center for ≥4 days from 7/2015-4/2019 who received enoxaparin VTE prophylaxis per protocol (<60kg: 30mg BID, 60-99kg: 40mg BID, >100kg: 50mg BID) and had an appropriately timed anti-Xa level. Multivariate regression was performed to identify predictors of in-range prophylactic anti-Xa (PAX) levels on the first assessment.

Results: The cohort (n=779) was 72.8% male, mean age 49.8 ± 20.0 years, weight 82.5 ± 21.0 kg (males mean 85.5kg, females 74.4kg), and ISS 15.3 ± 10.3. Overall, 67.0% had an in-range PAX on first assessment. Males were more likely to have a sub-PAX level (24.1% vs. 9.0%, p<0.001), while females were more likely to have supra-PAX levels (25.9% vs. 8.1%, p<0.001); rates of in-range PAX levels were equivalent. When controlled for creatinine clearance, PAX level was independently associated with dose:weight ratio (OR 0.43, p<0.001, CI 0.33-0.52) and sex (OR -0.06, p<0.001, CI 0.08-0.05).



Conclusion: Female patients were more likely to have supra-PAX levels compared to male patients at all dose:weight ratios. To improve the accuracy of VTE chemoprophylaxis, inclusion of sex in dosing models should be considered.

THE GREAT EQUALIZER: COVID-19 AND THE INJURED PATIENT. A MULTI-INSTITUTIONAL REVIEW

Hazim Hakmi MD; Abin Sajan MD; Patrizio Petrone MD, PhD; Gerard Baltazar DO; Nicole Goulet MD; Ricardo Jacquez MD; Adam Stright MD; Shahidul Islam DrPH; Laura Velcu MD; Jasmin Divers PhD; D'Andrea K Joseph MD
NYU Langone

Introduction: COVID-19 has been shown to affect outcomes in surgical patients. We hypothesized that COVID-19 would worsen the outcome of trauma patients, regardless of the Injury Severity Score (ISS).

Methods: We undertook a retrospective analysis of trauma registries from two level I trauma centers (suburban and urban) from 3/1/2020 to 6/30/2020 and 3/1/2019 to 6/30/2019, comparing baseline characteristics and cumulative adverse events. Patients were categorized as either COVID (+) or COVID (-) based on PCR, ICD-10, or COVID-19 diagnosis. Data collected included ISS, demographics, and comorbidities. The primary outcome was time from hospitalization to mortality. Outcomes during the height of the pandemic were also compared to the same timeframe in the prior year. Kaplan-Meier method with Log-rank test and Cox proportional hazard models were used to compare outcomes.

Results: 1180 patients were admitted during the study period from March 2020 to June 2020. Of these, 596 were not tested for COVID-19 and were excluded. There were 148 COVID+ patients and 436 COVID- patients. Compared to the 2019 cohort, the overall 2020 cohort was older with more associated comorbidities and adverse events but lower ISS. Statistically significant higher rates of hypertension (81.8% vs. 66.1%, $p<0.001$), diabetes (38.5% vs. 26.2%, $p=0.004$), neurologic (37.4% vs. 24.1%, $p=0.002$), and coagulopathic (29.9%% vs. 14.7%, $p<0.001$) events were displayed in COVID+ patients, compared to COVID- patients. D-dimer and ferritin were unreliable indicators of COVID-19 positivity; however, CRP levels were higher in COVID+, relative to COVID- patients (median 66 vs. 25, $p=0.03$). Despite a lower median ISS among COVID+ compared to COVID- patients (4.0 vs. 5.0, $p<0.001$), COVID+ patients had longer LOS and higher rates of mortality [HR (95% CI)=2.7 (1.5, 5.2), $p=0.002$].

Conclusions: Trauma patients with COVID-19 admitted to the trauma centers had increased morbidity and mortality compared to COVID-19 positive patients regardless of ISS. A better understanding of the physiologic impact of COVID-19 on injured patients warrants further investigation.

Poster #20

VALIDATION OF A NOVEL BLOOD VOLUME-BASED DOSING PROTOCOL FOR VENOUS THROMBOEMBOLISM PROPHYLAXIS IN TRAUMA PATIENTS

Elizabeth A. Langenstroer PharmD; Thomas W. Carver MD, FACS; David J. Herrmann PharmD, BCCP; Mary M. O'Keefe PharmD; Sara Hubbard PharmD, MSHS; Leah Holschbach PharmD; Lisa Rein MS; William J. Peppard, PharmD, BCPS, FCCM
Froedtert Memorial Lutheran Hospital

Introduction: Fixed-dose and body mass index (BMI) based enoxaparin regimens provide inadequate venous thromboembolism (VTE) prophylaxis for many trauma patients. Our previous investigation found that mg of enoxaparin per L of estimated blood volume (BV) correlated most strongly with anti-Xa level compared to body mass and BMI. BV has replaced BMI as the basis for VTE prophylaxis dosing at our institution.

Methods: This was a pre/post study evaluating the effectiveness of the historical BMI-based protocol (pre group) versus the novel BV-based protocol (post group) at a large academic Level 1 Trauma Center. All adult trauma patients admitted from Oct-Dec 2019 (pre) and Aug-Oct 2020 (post) who received enoxaparin per protocol, and had an anti-Xa level drawn, were included. The BV protocol was as follows: patients with a BV 3-4.9 L = enoxaparin 30 mg q12h, a BV 5-6.9 L = 40 mg q12h, and a BV ≥7 L = 60 mg q12h. The primary outcome was the percentage of patients who attained a target anti-Xa peak level (0.2-0.5 units/mL). Secondary outcomes included bleeding and VTE rates.

Results: A total of 241 patients (99 BMI, 142 BV) were included. Groups were similar, except the BV group was more often white with a higher creatinine clearance. The study population had a median age of 38 vs 41.5 years, a mean BMI of 27.4 vs 27.7, and a mean BV of 5.1 vs 5.1, respectively. A total of 63 patients (63.6%) in the BMI group attained target anti-Xa levels compared to 115 patients (81%) in the BV group (p=0.008). Upon multivariate regression, the BV-based protocol was the only variable associated with attainment of target anti-Xa levels (adjusted OR 1.93, p=0.018). Clinically relevant bleeding and VTE rates were similar between groups, 4 vs 2.1% and 1 vs 3.5%, respectively.

Conclusion: Dosing prophylactic enoxaparin using a novel BV-based dosing protocol significantly increased attainment of target anti-Xa levels and may provide more adequate VTE prophylaxis in trauma patients.

Poster #21

"JUST GET A PAN-SCAN" - PHYSICAL EXAM IS NOT AN ACCURATE PREDICTOR OF SIGNIFICANT INJURIES IN GERIATRIC PATIENTS WITH LOW-ENERGY BLUNT TRAUMA

Samuel Hawkins MD; Shreya Pandya MBBS, MPH; Thomas Kania MD; Christopher Governo RN, MS; Krassimir Atanassov MD; Shreya Reddy; Seleshi Demissie DrPH; Asaf Gave MD

Background: It is commonly accepted that geriatric patients with even low-energy traumatic mechanisms require a "pan-scan" as part of their trauma assessment, however it would be advantageous from a resource use perspective to scan selectively. Evidence from observational studies is conflicting. We hypothesized that for geriatric patients (≥65y) presenting to the emergency department with ground level falls the physical exam is sensitive enough to identify patients that require pan-scan.

Methods: We queried the trauma registry at a large, urban Level 1 trauma center for the calendar year 2019 for patients ages ≥65 with mechanism of fall from sitting or standing and performance of "pan-scan" at time of assessment. Exclusion criteria included falls from height, GCS <14, and absence of complete pan scan. Physical exam was extracted from the EMR. "Significant injuries" were defined as injuries that were diagnosed on CT and that changed management

Results: 751 patients were included in analysis. Of these, 296 (39%) had a positive CT for significant injury and 455 (61%) were negative. Median age was 84 years old. 269 (36%) were male and 482 (64%) were female. The majority of injuries identified were fractures, followed by visceral injuries. Sensitivity of the physical exam for serious injuries found on the full or any part of the pan scan did not exceed 70%.

Table 1: Physical Exam and CT "Pan-Scan" Results			
	PE (+)	**PE (-)**	**PE Sensitivity**
Pan-Scan (+)	**204**	**92**	**0.69**
Head CT (+)	**33**	**20**	**0.62**
C-spine CT (+)	**7**	**28**	**0.20**
C/A/P CT (+)	**174**	**122**	**0.20**

Conclusion: The physical exam was not sufficiently sensitive to safely exclude geriatric trauma patients with low-energy mechanism from undergoing any part of a pan-scan.

Poster #22

GROUND-LEVEL FALLS IN GERIATRICS ARE LOW-IMPACT INJURIES WITH HIGH-IMPACT CONSEQUENCES: HOW DOES FRAILTY FACTOR IN?

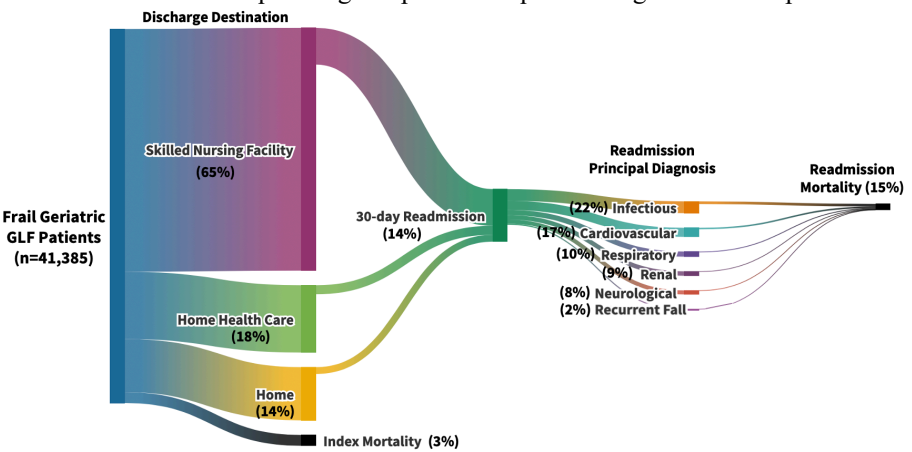
Mohamad Chehab MD; Letitia Bible MD; Ahmad Hammad MD; Molly Douglas MD; Omar Obaid MD; Adam Nelson MD; Lourdes Castanon MD, FACS; Michael Ditillo DO, FACS; Andrew Tang MD, FACS; Bellal Joseph, MD, FACS
The University of Arizona

Introduction: Ground-level falls (GLFs) in geriatrics are increasing with the increase in life expectancy, and more patients are being discharged to skilled nursing facility (SNF) for continuity of care. GLF patients are not a homogenous cohort, and the role of frailty remains to be assessed. The aim of this study is to examine the impact of frailty on long-term outcomes of GLF patients.

Methods: This is a cohort analysis from the Nationwide Readmissions Database 2017. Geriatric (age ≥65 years) trauma patients presenting following GLFs were identified and grouped based on their frailty status. The associations between frailty and 30-day mortality and emergency readmission were examined by multivariate regression analyses adjusting for patient demographics and injury characteristics.

Results: A total of 100,850 geriatric GLF patients were identified (frail: 41% vs. non-frail: 59%). Frail GLF patients were younger (81[74-87] vs. 83[76-89] years; p<0.001) and less severely injured ISS (4[1-9] vs. 5[2-9]; p<0.001). Frail patients had higher index mortality (2.9% vs. 1.9%; p<0.001) and 30-day readmissions (14.0% vs. 9.8%; p<0.001). Readmission mortality was higher in the frail group (15.2% vs. 10.9%; p<0.001), with 75.2% of those patients readmitted from SNF. **(Figure)** On multivariate analysis, frailty was associated with 30-day mortality (OR 1.75; p<0.001) and 30-day readmission (OR 1.49; p<0.001).

Conclusion: Frail patients are at 75% higher odds of mortality and 50% higher odds of readmission following GLFs. Of those emergently readmitted, more than one in seven patients died, 75% of whom were readmitted from SNF. This underscores the need for optimization plans that extend to the post-discharge period to reduce readmissions and subsequent high-impact consequences in geriatric GLF patients.



Poster #23

MORE HARM OR GOOD? OPERATIVE FEEDING TUBE MORTALITY IN ELDERLY TRAUMA PATIENTS

Maxwell C. Braasch, MPH; Khaled M. Taghlabi, MBBS; Robert D. Winfield, M.D., FACS
University of Kansas Medical Center

Introduction: Placement of feeding tubes in elderly patients has been associated with poor outcomes in general medical patient populations; however, this issue has not been studied in elderly trauma patients. The objectives of this study were to determine in-hospital mortality in elderly trauma patients receiving operative feeding tubes and to identify factors associated with in-hospital mortality.

Methods: A retrospective study utilizing 2017 National Trauma Data Bank data was conducted. Trauma patients aged 65 and older with operative feeding tube placement were included in analysis. Demographic, injury related, medical comorbidity, and general hospital course data was analyzed. Patients were divided into two cohorts: those who survived and those who did not survive to hospital discharge. Bivariate analysis was used to compare the groups with performance of subsequent logistic regression to determine factors independently associated with in-hospital mortality.

Results: A total of 3,398 patients were included in analysis with 331 (9.7%) dying during hospitalization. Overall, patients had a median age of 75 years, were mostly male (66%), injured by blunt mechanism (95%), and sustained severe injuries (median ISS 17). Patients who died were noted to be slightly older (76 vs. 75 years, $p=0.03$), be more severely injured (ISS 22 vs. 17, $p<0.001$), have a higher geriatric trauma outcome score (134 vs. 121), and lower rates of dementia (8 vs. 13%, $p=0.01$). Multivariate regression found that male sex, lower admission GCS, higher Charleston Comorbidity Index, and an Advance Directive Limiting Care (ADLC) were independently associated with in-hospital mortality in elderly trauma patients who received an operative feeding tube. Dementia diagnosis was negatively associated with in-hospital mortality.

Conclusions: The in-hospital mortality rate for elderly trauma patients with operative feeding tubes placed was found to be notably high at 9.7%. The results that male sex, higher admission GCS, higher comorbid disease burden, and the presence of an ADLC are associated with increased in-hospital mortality will serve to assist providers in counseling patients and caregivers about the risks associated with operative feeding tube placement in this patient population.

Poster #24

PARAVERTEBRAL NERVE BLOCK VS. EPIDURAL ANALGESIA IN GERIATRIC RIB FRACTURES: ARE WE TOO INVASIVE?

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Introduction: Multiple pain control modalities exist for rib fracture patients. The use of epidural analgesia (EA) in older adults has been associated with a high-risk profile. The aim of our study is to compare outcomes among geriatric rib fracture patients who received PVNB vs. EA.

Methods: We queried the (2011-2015) Nationwide Readmission Database to include geriatric (≥65y) trauma patients with rib fractures. We excluded patients who were dead on arrival, those with head-AIS ≥3, spine-AIS >0, penetrating injuries, and cognitive impairment. Propensity score matching was performed (1:2 ratio). Primary outcomes were delirium, length of stay (LOS), and mortality. Secondary outcomes were respiratory complications, readmission, and mechanical ventilation (MV).

Results: We included 2,855 patients, from which a matched cohort of 1,041 patients was obtained (347 received PVNB vs. 694 received EA). Mean age was 78±8y, chest-AIS was 3[2-3], and ISS was 9[4-16]. Majority of patients (70%) had >3 rib fractures. No difference was found in rates of delirium (12.4% vs. 12.9%; p=0.81), LOS (5[3-9] vs. 6[4-11]; p=0.63), index-hospital mortality (5.2% vs. 6.8%; p=0.30), 90-day mortality (7.6% vs. 8.4%; p=0.65), respiratory complications (10.1% vs. 10.4%; p=0.85), readmission (20.1% vs. 16%; p=0.27), and MV (7.5% vs. 7.4%; p=0.94) between the two groups.

Conclusion: The use of PVNB in geriatric trauma patients with multiple rib fractures is associated with comparable in-hospital and post-discharge outcomes relative to EA. PVNB is relatively easy to perform and has a better side effect profile. The use of PVNB as part of rib fracture management protocols warrants further consideration.

Poster #25

PRE-INJURY HEALTHCARE USE TRAJECTORIES AND POST-INJURY PATIENT-REPORTED OUTCOMES IN OLDER TRAUMA PATIENTS

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Background: Previous work revealed considerable variability in the long-term Health Related Quality of Life (HRQoL) recovery trajectories of patients after non-neurologic injury. However, little is known about how pre-injury health trajectories might influence HRQoL at the time of injury. Healthcare information exchanges (HIE) could be used to determine pre-injury health trajectory and to predict baseline HRQoL as well as those who might need post-discharge support. The purpose of this study was to identify and describe pre-injury healthcare utilization trajectories using data from a statewide HIE for the two-year period prior to injury in non-neurologically injured older patients. We compared patient-reported HRQoL outcomes across trajectory groups at index hospitalization for trauma.

Methods: Healthcare use data was obtained from a local HIE for 156 patients enrolled in a longitudinal cohort recruited into a randomized controlled trial. Healthcare use scores were calculated for each quarter of the two-years prior to injury and group-based trajectory modeling was performed to identify unique pre-injury healthcare use trajectory groups. Descriptive statistics were conducted to compare group characteristics. ANCOVA was used to compare patient-reported HRQoL after injury.

Results: Three utilization trajectories, dubbed “low”, “medium”, and “high” utilization, were identified. The majority of patients (n=103) belonged to the low utilization group while n=44 and n=9 patients belonged to the medium and high utilization groups, respectively. The groups significantly differed with respect to Charlson score, racial composition, insurance status, education, and mechanism of injury at index hospitalization. The prevalence of anxiety and depression were similar among groups. The trajectory groups differed significantly in the physical role functioning, energy & fatigue, social functioning, and general health subscales of the SF-36 after adjusting for age, sex, Charlson score, ISS, and mechanism of injury.

Conclusions: Three distinct healthcare utilization trajectories were identified. Preinjury healthcare utilization is significantly associated with physical and social functioning, energy and fatigue, and general health perceptions after non-neurologic injury in older patients. This is the first description of using a HIE to determine pre-injury health trajectories in an injured population. This proof-of-concept study suggests that magnitude of healthcare utilization, which can be calculated using widely available HIE data, can help identify patients at risk of low HRQoL at the time of injury.

Poster #26

UNDERSTANDING PREVENTABLE DEATHS IN THE GERIATRIC TRAUMA POPULATION: ANALYSIS OF 1,567,650 PATIENTS FROM THE CMS AND AHRQ DATABASES

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Background: Patient safety indicators (PSIs) are avoidable complications that can impact outcomes. Geriatric patients have a higher mortality than younger patients with similar injuries, and understanding the etiology may help reduce patient mortality. We aim to estimate preventable geriatric trauma mortality in the US and identify risk factors associated with increased mortality.

Methods: A retrospective cohort study of patients aged ≥65, in the CMS and AHRQ databases from 2011-2013. Risk-adjusted multivariable regression was performed to calculate observed-to-expected (O/E) mortality ratios for failure-to-prevent and failure-to-rescue PSIs with significance defined as $p< 0.05$.

Results: 1,567,650 geriatric patients were analyzed. Patients aged 75-84, had 63% higher odds of preventable mortality (adjusted odds ratio [aOR]=1.63, 95% confidence interval [CI]=1.58,1.68) whereas patients aged ≥85 had 149% higher odds of preventable mortality (aOR=2.49, 95% CI=2.42,2.56) compared to patients aged 65-74. Failure-to-prevent O/Es were >1 for all PSIs evaluated with physiologic and metabolic derangements having a high O/E (56.28). Failure-to-rescue O/Es were >1 for 9/11 (81.8%) PSIs with physiologic and metabolic derangements having the highest O/E (2.72). US states with higher quantities of geriatric trauma patients experienced reduced preventable mortality.

Conclusion: Odds of preventable mortality increases with age. In-hospital postoperative hip fracture and physiologic/metabolic derangements produce significant preventable mortalities. US states differ in their failure-to-prevent and failure-to-rescue PSIs, indicating geographic variations in geriatric trauma care may exist. Utilization of national guidelines, early correction of metabolic derangements, more through history taking, and greater incorporation of inpatient geriatricians may serve to reduce preventable mortality in elderly trauma patients.

Poster #27

COMPARISON OF NEBULIZED KETAMINE AT THREE DIFFERENT DOSING REGIMENS FOR TREATING ACUTE AND CHRONIC PAINFUL CONDITIONS

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Introduction: Ketamine is a noncompetitive NMDA/glutamate-receptor complex antagonist that decreases pain by diminishing central sensitization and hyperalgesia. Our goal was to assess and compare the analgesic efficacy and rates of adverse effects of ketamine administered via breath-actuated nebulizer at three different dosing regimens for patients presenting with acute and chronic painful conditions.

Methods: This was a prospective, randomized, double-blinded trial comparing three doses of nebulized ketamine (0.75mg/kg, 1 mg/kg and 1.5 mg/kg) administered via breath-actuated nebulizer, in adult Emergency Department patients aged 18 years and older with moderate to severe acute and chronic pain. Primary outcome included the difference in pain scores between all three groups at 30 minutes.

Results: We enrolled 120 subjects (40 per group). Difference in mean pain scores at 30 minutes between the 0.75 mg/kg and 1 mg/kg groups was 0.25 (95% confidence interval [CI]: -1.28 to 1.78), between the 1 mg/kg and 1.5 mg/kg groups was -0.225 (95% CI: -1.76 to 1.31), and between the 0.75 mg/kg and 1.5 mg/kg groups was 0.025 (95% CI: -1.51 to 1.56). No clinically concerning changes in vital signs were observed. No serious adverse events occurred in any of the groups.

Conclusion: Nebulized ketamine administered at the 1.5 mg/kg dose via breath-actuated nebulizer did not provide superior analgesia to nebulized ketamine at the 0.75 mg/kg and the 1 mg/kg for short-term treatment of moderate to severe pain in the Emergency Department and resulted in slightly higher rates of dizziness and fatigue.

Poster #28

EFFICACY OF FASCIA ILIACA COMPARTMENT BLOCK FOR HIP FRACTURES: DOES TYPE OF BLOCK MATTER?

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Introduction: The AAOS surgical guidelines for hip fracture in the elderly strongly recommend regional analgesia to improve preoperative pain control. Regional blockade of the fascia iliaca (FICB) can be administered as a continuous infusion or a single injection. We sought to determine differences in pain, analgesia, and delirium by FICB administration type compared to systemic analgesics alone.

Methods: This study was designed as an a priori subset analysis of a prospective, multicenter, observational cohort of geriatric adults with unilateral traumatic hip fracture requiring surgery. We excluded patients admitted to facilities that did not perform both types of FICB (n=99) and FICB placed postoperatively (n=24). Outcomes were development of delirium within 48h postoperatively (primary outcome, %), mean self-reported pain (0-10 scale), median oral morphine equivalent (OME) consumption, and analgesic-related complications (%).

Results: There were 394 patients, 215 (55%) received a continuous FICB, 69 (18%) received a single injection FICB, and 110 (28%) did not receive FICB. There were no differences in delirium between continuous, single, and no FICB groups (5.1%, 4.4% and 3.6%, p=0.82). There were no differences in OME consumption in the preoperative period (24mg, 27mg, 23mg, respectively; p=0.95) or in the postoperative period (34mg, 41mg, 31mg, respectively; p=0.60). There were also no differences in analgesic complications (4.2%, 2.9%, 1.8%, respectively; p=0.52). Arrival pain was similar between groups (p=0.43), while pain scores were significantly lower with continuous FICB and single FICB compared to no FICB, at admission (5.5, 4.7, 6.4, respectively; p<0.001) and preoperatively (3.8, 3.4, 4.9, p<0.001). Moreover, admission pain was significantly lower with single FICB than continuous FICB (p=0.03).

Conclusion: Compared to patients receiving systemic analgesia only, both FICB types were equally effective at reducing pain in the preoperative period. There was no treatment effect for either type of block on delirium, opioid consumption, and analgesic-related complications. These data suggest the pain sparing benefit of FICB does not result in an accompanying reduction in narcotics or delirium.

Poster #29

POSTOPERATIVE MORTALITY IN HIP FRACTURE PATIENTS STRATIFIED BY THE REVISED CARDIAC RISK INDEX: A SWEDISH NATIONWIDE RETROSPECT COHORT STUDY

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Introduction: The Revised Cardiac Risk Index (RCRI) is a tool that can be used to evaluate the 30-day risk of postoperative myocardial infarction, cardiac arrest, and mortality. This study aims to confirm its association with postoperative mortality in patients who underwent hip fracture surgery.

Methods: All adults who underwent primary emergency hip fracture surgery in Sweden between 1/1/2008 and 31/12/2017 were included in this study. The database was retrieved by cross-referencing the Swedish National Quality Register for hip fractures with the Swedish National Board of Health and Welfare registers. The outcomes of interest were the association between the RCRI score and mortality at 30 days, 90 days and one year postoperatively.

Results: 134,915 cases were included in the current study. There was a statistically significant linear trend in postoperative mortality with increasing RCRI scores at 30 days, 90 days and one year. An RCRI score ≥4 was associated with a 3.1 times greater risk of 30-day postoperative mortality (adj. IRR 3.13, $p<0.001$), a 2.5 times greater risk of 90-day postoperative mortality (adj. IRR 2.54, $p<0.001$), and a 2.8 times greater risk of 1-year postoperative mortality (adj. HR 2.81, $p<0.001$) compared to that observed with an RCRI score of 0.

Conclusion: An increasing RCRI score is strongly associated with an elevated risk 30-day, 90-day, and 1-year postoperative mortality after primary hip fracture surgery. The objective and easily retrievable nature of the variables included in the RCRI calculation makes it an appealing choice for risk stratification in the clinical setting.

Poster #30

THE PUBLIC HEALTH BURDEN OF GERIATRIC TRAUMA CARE: ANALYSIS OF 2,684,983 HOSPITALIZATIONS FROM CMS INPATIENT CLAIMS

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Introduction: Geriatric trauma care (GTC) represents an increasing proportion of injury care, but associated public health research on outcomes and expenditures is limited. The purpose of this study was to describe GTC characteristics, location, diagnoses, and expenditures.

Methods: Patients at short-term, non-federal hospitals aged ≥65 with ≥1 injury ICD-10 code were selected from 2016-19 CMS Inpatient Standard Analytical Files (IPSAF). Trauma center levels were linked to the IPSAF file via AHA Hospital Provider ID and fuzzy string matching. Patient demographics, care location, diagnoses, and expenditures were compared across groups.

Results: 2,684,983 hospitalizations (62% female; 90% white; 71% falls) from 3,286 hospitals were included. Level I centers treated 21.2% and non-trauma centers treated 37.7%. The most frequent primary diagnoses were hip/femur fracture in 28.3% followed by TBI in 10.1% (Table). Expenditures totaled $32.8B (1.1% of annual Medicare budget). Overall mortality rate was 3.5%.

Trauma Centers		*ISS Mean*	*Total hospitalizations n (%)*	*Most frequent 1º diagnosis*	*2nd most freq. 1º diagnosis*	*Expenditures $B (%)*
Level	**Number (%)**					
I	236 (7.2)	7.4	568,898 (21.2)	Hip/femur (19.8)	TBI (17.6)	9.20 (28.1)
II	333 (10.1)	6.8	617,136 (23.0)	Hip/femur (25.7)	TBI (13.4)	7.27 (22.2)
III	455 (13.8)	6.4	382,482 (14.2)	Hip/femur (33.6)	Medical (9.9)	4.15 (12.6)
IV	339 (10.3)	6.1	104,259 (3.9)	Hip/femur (35.2)	Medical (10.8)	1.08 (3.3)
None	1923 (58.5)	6.0	1,012,208 (37.7)	Hip/femur (31.9)	Medical (10.6)	11.08 (33.8)
Total	**3,286 (100)**	**6.5**	**2,684,983 (100)**	**Hip/femur (28.3)**	**TBI (10.1)**	**32.79 (100)**

Conclusion: The largest proportion of GTC occurs at non-trauma centers, emphasizing their vital role in trauma care. Hip/femur fractures account for the largest portion of GTC. Public health prevention programs and GTC guidelines should be implemented by all hospitals, not exclusively trauma centers.

Poster #31

A DECADE OF PEDIATRIC FIREARM VIOLENCE: A CALL TO ARMS

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Introduction: Firearm injuries cause significant morbidity and mortality in children and adolescents. We characterized the epidemiology and predictors of mortality in pediatric victims of firearm violence in Northern California.

Methods: Trauma patients <18 years old at a level 1 pediatric trauma center presenting with gunshot wounds (GSW) 2009-2019 were included. The primary outcome was mortality. The secondary outcomes included interventions, massive transfusion (>40 ml/kg of blood products within 24 hours of arrival), costs, and recidivism, defined as presenting again with another GSW. Significance was set at $p<0.05$.

Results: There were 295 GSWs (2.1%), with 7.5% mortality (n=22/295) out of 13,840 pediatric trauma patients. Thirty-six percent were taken straight to the operating room, 42% were admitted to the ward, and 22% were admitted to the intensive care unit. Half required surgery (54%). Seventeen patients received massive transfusion, with a higher mortality than those not receiving massive transfusion (53% vs. 5%, $p<0.0001$, Fisher's exact test). On multivariable analysis, after adjusting for age, sex, injury severity, massive transfusion, and year, massive transfusion was significantly associated with mortality (OR 4.4, 95% CI 1.1-17.2, $p=0.03$). The cost of these injuries was over $5.5 million. There were four cases of recidivism (2%) after a median interval of 108 days (range 48-1089).

Conclusions: Firearm violence in pediatric patients is highly lethal and is associated with a high level of resource utilization, with half requiring operative intervention. Patients receiving massive transfusion were significantly more likely to die. The index presentation may represent a key time for interventions to prevent future re-injury.

Poster #32

EFFICACY OF ANIMAL ASSISTED THERAPY IN THE TREATMENT OF PATIENTS WITH TRAUMATIC BRAIN INJURIES

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Introduction: Traumatic brain injury (TBI) is a serious public health concern accounting for nearly 3 million emergency department visits each year; the significant impact of severe TBI on the patient, family, and society has been extensively documented in the literature. Hospitals utilize a range of interventions to address the biopsychosocial and emotional needs of the patient. We aimed to understand how Animal Assisted Therapy (AAT), the use of the human/animal bond in goal-directed interventions, with dogs affects outcomes of patients hospitalized with severe TBI.

Methods: Adult patients admitted with severe TBI (GCS $\leq$ 10), were randomized to receive AAT during their hospitalization in a single Level I Trauma Center. Pre- and post- AAT session Glasgow Coma Scale (GCS), Rancho Los Amigos Scale (RLAS) and levels of command (LOCmd) scores were recorded; we used nonparametric Wilcoxon rank sum tests to identify differences between the groups.

Results: Study patients (N=70) received 151 sessions with a hander and dog (intervention, n=38) and 156 without (control, n=32) from a total of 25 dogs and 9 handlers. The mean change in intervention vs. control was 0.09 vs. -0.13 GCS (p= 0.03); 0.1 vs. 0.01 RLAS (p=0.002); 0.16 vs. 0.00 LOCmd (p=0.00). P-values were adjusted for multiple comparisons.

Conclusions: Patients with severe TBI receiving AAT with dogs demonstrated significant improvement following treatments, compared to a control group. AAT may be a valuable adjunct therapy for this population.

Patient Characteristics(N=70)	AAT (n=38)	Control (n=32)	Adjusted p-value
Average age (in years)	47	45	0.67
Sex, Male	22	28	0.01
Injury Severity score (ISS) 9-15	3	4	0.97
ISS $\geq$ 16	35	28	0.01
Interactions	151	156	0.34
Change following interaction	(mean scores)		
GCS	0.09	-0.13	0.03
RLAS	0.10	0.01	0.00
LOCmd	0.16	0.00	0.00

Poster #33

FIREARM VIOLENCE AGAINST CHILDREN IN THE UNITED STATES: TRENDS IN THE WAKE OF THE COVID-19 PANDEMIC

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Introduction: This study aimed to evaluate the patterns of firearm violence against children before and after the COVID-19 pandemic, as well as the patterns of specific types of firearm violence against children over time (2016-2020).

Methods: Retrospective firearm violence data were obtained from the Gun Violence Archive. Rate of firearm violence was weighted per 100,000 children. A scatterplot was created to depict the rate of total yearly child involved shooting incidents over time; with a linear trendline fit to 2016-2019 data to show projected versus actual 2020 firearm violence. All 50 states were sorted into either "strong gun law" (n=25) or "weak gun law" (n=25) cohorts. Bivariate and multivariate linear regressions were run for number of child-involved shootings over time.

Results: There were a total of 1,076 child-involved shootings in 2020, 811 in 2019 and 803 in 2018. Median total child involved shooting incidents per month increased from 2018 to 2020 (0.095 vs. 0.126, $p=0.002$) and from 2019 to 2020 (0.097 vs. 0.126, $p=0.007$). Child injured by self and child killed by adult incidents also increased in 2020 compared to 2018 ($p=0.012$, $p=0.017$) and 2019 ($p=0.017$, $p=0.033$). The scatterplot demonstrates that total child involved shootings in addition to both fatal and non-fatal firearm violence incidents exceeded the projected number of incidents extrapolated from 2016-2019 data. Multivariate linear regression demonstrated that, compared to weak gun law states, strong gun law states were associated with decreased monthly total child-involved shooting incidents between 2018 and 2020 ($p<0.001$) as well as between 2019 and 2020 ($p<0.001$).

Conclusions: Child-involved shooting incidents increased significantly in 2020 surrounding the COVID-19 pandemic. Given that gun law strength was associated with a decreased rate of monthly child-involved firearm violence, public health and legislative efforts should be made to protect this vulnerable population from exposure to firearms.

Poster #34

IMPROVED IDENTIFICATION OF SEVERELY INJURED PEDIATRIC TRAUMA PATIENTS USING REVERSE SHOCK INDEX MULTIPLIED BY GLASGOW COMA SCALE (RSIG)

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Background: The pediatric shock index (SI) predicts the need for increased resources and mortality among *bluntly* injured pediatric patients but underperforms in predicting resource needs for all pediatric trauma patients. A new scoring system, rSIG, which is the reverse shock index (rSI) multiplied by the Glasgow Coma Scale (GCS), has been shown to be superior at predicting outcomes in adult trauma patients and battlefield mortality in pediatric patients when compared to traditional scoring systems. We sought to compare the accuracy of rSIG to SI in predicting the need for early interventions among civilian pediatric trauma patients.

Methods: All pediatric patients (≤18 years old) in the 2014-2018 TQIP database with complete heart rate, systolic blood pressure, and total GCS were included. Optimal cut-points using rSIG and SI were calculated for predicting blood transfusion within four hours, intubation, hemorrhage control operation or angiography, intracranial pressure (ICP) monitoring, intensive care unit (ICU) admission, and mortality. From the optimal thresholds, sensitivity, specificity, and area under the curve (AUC) were calculated from receiver operating characteristics (ROC) analyses to predict each outcome.

Results: A total of 604,931 patients with a mean age of 11.1 years old were included. Over half (53.8%) of patients sustained a blunt injury mechanism and the mean Injury Severity Score was 7.6. rSIG performed better than age-unadjusted SI at predicting all outcomes for the overall population (Table 1).

Conclusions: rSIG outperformed SI in the early identification of traumatically injured children at risk for early interventions, such as blood transfusion within four hours, intubation, and mortality. rSIG may be utilized as a bedside triage tool to rapidly identify those patients who will likely require early interventions and higher levels of care.

Table 1. Optimal cutoff points for rSIG and SI, by outcome

	Predictor	Optimal Cutpoint	Sensitivity (%)	Specificity (%)	AUC
Blood transfusion within 4 hours	rSIG	16.9	82.8	60.4	**0.83**
	SI	1.6	14.7	98.9	0.70
Intubation	rSIG	17.4	8.5	59.1	**0.85**
	SI	1.5	9.3	98.4	0.57
ICP Monitor	rSIG	15.0	89.7	73.9	**0.90**
	SI	0.8	51.0	53.7	0.53
OR/Angiography	rSIG	20.7	32.1	84.7	**0.73**
	SI	1.7	98.3	8.3	0.61
ICU Admission	rSIG	19.4	70.5	43.8	**0.65**
	SI	1.4	6.9	97.7	0.54
Mortality	rSIG	14.4	55.6	77.4	**0.72**
	SI	0.8	67.2	40.1	0.58

Poster #35

ISOLATED PARESTHESIA IS NOT A RELIABLE PREDICTOR OF SPINE INJURY IN BLUNT TRAUMA

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Introduction: Isolated extremity paresthesia is a criterion for trauma team activation at some centers given a perceived concern for spine injury. The predictive nature of this finding is unknown, and unnecessary activation is associated with increased costs and resource utilization. We hypothesized that isolated paresthesia as identified in the trauma team activation page does not predict spine injury.

Methods: All adult blunt trauma activations with a GCS ≥ 12 at our urban level I trauma center between 1/1/2018 and 6/30/2020 were identified. Detailed trauma activation pages were reviewed for evidence of paresthesia and neurologic motor deficit to group patients into three categories: paresthesia only, paresthesia with deficit/deficit only and no paresthesia or deficit mentioned. Baseline and injury specific characteristics were compared between groups. Sensitivity, specificity, negative, and positive predictive values were calculated for isolated paresthesia on the primary outcome of spine injury (defined as a spine AIS ≥ 2). Receiver operator curves (ROC) were constructed.

Results: 995 patients met inclusion criteria; 132 (13%) had isolated paresthesia, 44 (4%) had paresthesia with deficit/deficit only, and 819 (82%) had no paresthesia or deficit. 264 (27%) had spine AIS ≥ 2, with overall median spine AIS of 0 [0-2]. Those with isolated paresthesia had a similar rate of spine injury compared to those without paresthesia or deficit (26% vs. 25%, p=0.91). Those with paresthesia with deficit/deficit only were more likely to have spine injury compared to those with isolated paresthesia (52% vs. 26%, p=0.001) and to those without paresthesia or deficit (52% vs. 25%, p<0.001). There was no difference in isolated paresthesia between those with and without spine injury (17% vs 14 %, p=0.21). The sensitivity, specificity, positive predictive value, and negative predictive value for isolated paresthesia on spine injury were 14%, 86%, 26% and 75%, respectively. Area under the ROC for the diagnostic accuracy of paresthesia on spine injury was 0.49 (95% CI 0.45-0.53).

Conclusion: In this sample of blunt trauma patients, isolated extremity paresthesia identified prior to trauma team activation was not predictive of spine injury. Future prospective studies are needed to substantiate these findings, which have implications for both resource utilization and costs of care.

Poster #36

LONG-TERM FUNCTIONAL OUTCOMES AFTER TRAUMATIC SPINE FRACTURES

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Introduction: Traumatic spine fractures (TSF) can result in chronic pain, disability, and prolonged rehabilitation. Data for long-term functional outcomes after TSF is lacking, with few reports on functional recovery after nonoperative compared to operative management strategies. We evaluated patients with TSF to determine the long-term impact of TSF on functional outcome after nonoperative and operative management.

Methods: Patients with TSF over a five-year period were identified and stratified by management strategy (nonoperative [NO] vs operative [OP]) and compared. Functional outcomes were measured using the Boston Activity Measure for Post-Acute Care (AM-PAC) to assess basic mobility (BM) and daily activity (DA). Multiple linear regression (MLR) was used to identify predictors of functional outcome after TSF.

Results: 488 patients were identified: 271 NO and 217 OP. Follow-up was obtained in 168 (34%) patients: 95 (35%) NO and 73 (34%) OP. Mean follow-up was 5.7 years (range 3-8 years). Patients with thoracic, multilevel spine, or concomitant pelvic fractures were more commonly managed non-operatively. The majority were discharged home regardless of management. Mean AM-PAC scores in patients managed NO for BM (68 vs 64, $p=0.09$) and DA (69 vs 66, $p=0.26$) were clinically similar to those managed OP. MLR identified increasing age as a predictor of decreased BM ($\beta=-0.50$, $p<0.0001$, $\beta=-0.17$, $p=0.022$) and DA ($\beta=-0.58$, $p<0.0001$, $\beta=-0.35$, $p=0.003$) in NO and OP groups, respectively. In NO patients, a thoracic spine fracture was predictive of both decreased BM ($\beta=-5.88$, $p=0.041$) and DA ($\beta=-8.62$, $p=0.043$). In OP patients, lower extremity fractures ($\beta=-8.86$, $p=0.012$), discharge location ($\beta=-6.91$, $p=0.003$), and time to operative fixation ($\beta=-0.77$, $p=0.040$) were predictors of decreased BM.

Conclusion: All patients with TSF displayed mild to moderate functional impairment regardless of management strategy. Increasing age and thoracic spine fractures worsened long-term functional outcomes in NO patients while increasing age, lower extremity fractures, and discharge location worsened functional outcomes in OP patients. Time to operative fixation emerged as the only potentially *modifiable* risk factor for improving outcomes following TSF.

Poster #37

THE SCOPE OF FIREARM INJURIES IN AMERICA: INTENT MATTERS

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Purpose: Firearm injuries are a public health crisis in the United States. Knowledge of the intent of injury and their outcomes can help direct interventions and prevention.

Methods: The Nationwide Readmissions Database from 2010-2014 was used to identify patients < 18 years admitted after firearm injury, categorized by intent (violent, self-inflicted, or unintentional). Demographics and outcomes were analyzed and compared to each intent type. Chi-squared analysis and Mann-Whitney U test were used for comparison between cohorts and significance was set at $p<0.05$.

Results: Over the five-year period, 12,832 children were admitted secondary to firearm injury. The cohort was 86% male, and 89% were over the age of 13. Mortality was 6%. The most common locations of injury were the extremities (47%), abdomen (21%), and chest (19%). Operative procedures were performed in 63%, with the most common being orthopedic interventions (34%), exploratory laparotomy (21%), or soft tissue repair (20%). Overall readmission rate within 30 days was 5% and 11% within a year. Unplanned readmissions were most common (72%) due to operative intervention (35%), infection (22%), complications of spinal cord injury/paralysis (11%) or venous thromboembolism (4%). Violence was the most common intent of injury (65%), follow by unintentional (31%), and self-inflicted (5%). Self-inflicted injuries had the highest injury severity, were more likely to cause brain injury, carried the highest hospital charges, readmission rate, and had significantly higher mortality, **Table 1**. Violent injuries were more common in low-income patients, more often required exploratory laparotomy and had the highest rate of trauma recidivism.

Conclusion: Firearm injuries are a frequent cause of morbidity and mortality in children. Violent, accidental, and self-inflicted injuries carry their own unique patterns and outcomes. These findings can help target future efforts to decrease the burden of this preventable public health crisis.

Table 1: Comparison of demographics and outcomes by firearm intent

	Self-Inflicted (n=617)	**Violent** (n=8280)	**Unintentional** (n=3935)	P=
Age <13	10%	6%	24%	<0.001
ISS[a]	16 [9-25]	11 [5-22]	9 [4-17]	<0.001
Low Income[b]	34%	59%	53%	<0.001
Brain Injury	56%	8%	8%	<0.001
Exploratory Laparotomy	12%	24%	17%	<0.001
Hospital Charges[a]	$61,449 [66,223-145,621]	$44,328 [22,175-93,899]	$37,308 [18,908-73,699]	<0.001
Readmission Rate	15%	10%	12%	<0.001
Trauma Recidivism[c]	0%	8%	3%	<0.001
Mortality	37%	4%	5%	<0.001

a. data presented as median [interquartile range]; b. lowest income quartile; c. readmission for repeat unrelated (new) trauma within the year

Poster #38

DOES THROMBOELASTOGRAPHY PREDICT PREINJURY ANTICOAGULATION IN TRAUMATIC BRAIN INJURY?

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Introduction: Thromboelastography (TEG) is a widely used tool to assess post-traumatic coagulopathy. The aim of this study was to evaluate the effect of pre-injury anticoagulants on TEG parameters in severely injured Traumatic Brain Injury (TBI) patients.

Methods: We performed a 2-year retrospective analysis of our prospectively maintained TBI database. We included all adult (age >18) TBI (Head AIS ≥3) patients who received a TEG within the first 24 hours of presentation. We excluded patients with bleeding disorders/liver disease and those who were transferred. Patients were stratified as having received pre-injury AC or no-AC. We performed 1:2 propensity score matching. Outcome measures were TEG and conventional coagulation test parameters, intracranial hemorrhage (ICH) progression on CT scan, and mortality.

Results: A total of 198 patients were analyzed (AC, n = 66 vs. no-AC, n = 132). Post-match characteristics were similar between the two groups, including age (p=0.78), gender (p=0.76), ISS (p=0.09), GCS (15 vs. 14; p=0.23) and head-AIS (3[3-4] vs. 3[3-4]; p=0.64). Reaction time was significantly prolonged in AC group as compared to no AC (p=0.04). There were no differences in the other TEG parameters including K-value, alpha angle and maximum amplitude. Conventional tests, including the international normalized ratio (INR) and activated partial thromboplastin time (aPTT), were significantly deranged in AC group. ICH progression on repeat head CT was significantly higher in AC group compared to no AC (30% vs. 17%; p=0.02). There were no differences in the two groups in terms of neurosurgical intervention (12% vs. 8%; p=0.45), in-hospital LOS (days) (10 vs. 9; p=0.88) and mortality (18% vs.15%; p=0.69).

Conclusion: TEG has a limited clinical utility to evaluate pre-injury anticoagulants. Although, TEG can be used to assess trauma induced coagulopathy, its role in patients with preinjury anticoagulant therapy merits further evaluation.

Parameters	Anticoagulants (n=66)	No-Anticoagulant (n=132)	*p-value*
Thromboelastography			
Reaction Time (minutes), mean ± SD	4.7 ± 1.2	4.1 ± 1.6	**0.04**
K value (minutes), mean ± SD	1.1 ± 0.7	1.2 ± 0.5	0.18
Alpha Angle (degrees), mean ± SD	65 ± 8.6	65 ± 7.2	0.84
Maximum Amplitude (mm), mean ± SD	64 ± 6.0	66 ± 5.7	0.77
Conventional			
aPTT (seconds), mean ± SD	31 ± 6.5	26 ±4.5	**<0.01**
INR, mean ± SD	1.8 ± 1.4	1.1 ± 0.2	**<0.01**

Poster #39

INCREASED NEED FOR SWALLOW THERAPY AMONG TRAUMA PATIENTS WEARING CERVICAL COLLARS

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Background: Up to 93% of patients with traumatic brain injuries (TBI) develop dysphagia which can lead to aspiration, pneumonia, and death. Cervical collars (c-collars) restrict pharyngoesophageal segment opening, increase hyoid anterosuperior elevation and epiglottic inversion times which could increase the risk for dysphagia.

Methods: This retrospective study included geriatric patients (aged ≥ 65 years old) with a TBI or cervical spine injury admitted to a level I trauma center from January 2016 to December 2018. Patients who had a c-collar placed were compared to patients who did not. The primary outcome was swallow therapy for dysphagia. Secondary outcomes included: aspiration, pneumonia, respiratory failure, and death.

Results: 704 patients were included, 21.2% had a c-collar and 78.8% (555) did not. Overall, the mean (SD) age was 77.0 (7.5), 49.9% were female, and the mean injury severity score was 13.4 (8.0). Patients were comparable in demographics, ISS and GCS. There was a significantly higher proportion of patients with a c-collar who had swallow therapy for dysphagia than patients without a c-collar [54.4% (81) vs. 38.0% (211), $p<0.001$]. Respiratory failure occurred significantly more frequently in patients with a c-collar than patients without [16.8% (25) vs. 6.7% (37), $p<0.001$]. Although not statistically significant, aspiration occurred more frequently in patients with a c-collar than without, [7.4% (11) vs. 4.1% (23), $p=0.10$], as did in-hospital mortality [8.7% (13) vs. 4.7% (26), $p=0.06$]. The proportion of patients who had pneumonia was similar between groups ($p=0.88$). After adjustment, patients with a c-collar had significantly higher odds of needing swallow therapy for dysphagia [OR (CI): 1.9 (1.3, 2.8)] and for respiratory failure [OR (CI): 2.8 (1.6, 5.1)]. After adjustment, wearing a c-collar did not significantly increase the odds of aspiration [OR (CI): 1.9 (0.9, 3.9)], pneumonia [OR (CI):0.8 (0.3, 2.3)] or death [OR (CI): 1.6 (0.7, 3.6)].

Conclusions: Although there was no difference in the rate of aspiration between groups, patients with c-collars were at an increased risk for needing swallow therapy for dysphagia and respiratory failure. Screening for dysphagia and aspiration among patients with a c-collar may reduce the risk of subsequent complications.

Poster #40

PEDIATRIC PEDESTRIAN INJURIES: STRIKING TOO CLOSE TO HOME

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Purpose: Pediatric pedestrian injuries (PPI) are a major health care concern, especially in urban trauma centers. Identifying clusters of events can help influence public policy.

Methods: PPI injuries ≤ 18 years treated at our Level 1 trauma center from 10/2013-3/2020 were retrospectively reviewed. Demographics, injuries, and outcomes were analyzed. ArcGIS Pro 2.6.1 was used to geocode home and injury locations to measure Euclidean distance from home to each incident. Incidents were aggregated to zip codes and the Local Indicators of Spatial Association (LISA) statistic was used to test for spatial clustering of injury rates per 10,000 children.

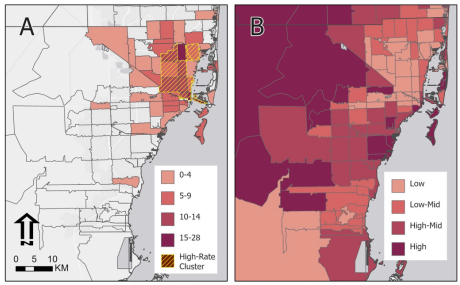

Figure 1. A. County distribution of pediatric pedestrian hit by car injuries (per 10,000 age 0-18 years) aggregated by zip code, treated between October 2013 and March 2020. B. County distribution of 2018 median household income quartiles.

Results: There were 176 cases of PPI identified, for an incidence of 6% of pediatric traumas. Most patients were African American (51%), male (58%), >13 years (59%), and had Medicaid insurance (67%). The most common injuries were traumatic brain injuries (26%) and orthopedic (26%). Injuries occurred primarily (84%) during non-school hours (2PM to 8AM) and in zip codes with lower household income (Figure 1B). The mean distance of injury location from home was 5.8 ± 10.7 kilometers (km), with 40% and 51% of injuries occurring within 1 km and 2 km from home, respectively. Nine zip codes encompassing several interstate exists and the connected heavy-traffic roadways comprise a statistically significant cluster of PPI rates (Figure 1A).

Conclusions: Pediatric pedestrian injuries most often occur near the home and in zones corresponding to low-income neighborhoods in close proximity to major roadways. This analysis, along with multidisciplinary injury prevention collaboration, can direct local safety programs and provide a model at the national level.

Poster #41

A NATIONAL TRAUMA DATA BANK® ANALYSIS: MORTALITY IN PATIENTS WITH PSYCHIATRIC COMORBIDITY

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Background: Pre-existing psychiatric comorbidity (PSYCH-COMD) is over-represented in patients who experience injury, with a reported prevalence of 11.5-63% at the time of admission. Prior works are mixed on the effects of PSYCH-COMD in terms of outcomes and are limited to single-center studies and studies that do not distinguish psychiatric illness from other mental altering comorbidities. In this study we aimed to use a nationally representative dataset to determine short-term outcomes in injured patients with concomitant PSYCH-COMD at the time of admission. We hypothesize that those with PSYCH-COMD will have worse short-term outcomes compared to those without.

Methods: A total of 751,459 patients from the National Trauma Data Bank (NTDB) in 2017 who were 18 years or older and admitted for at least 24 hours were analyzed. 177,708 patients were in the PSYCH-COMD group, and 573,751 patients in the no PSYCH-COMD group. Descriptive statistics were performed to compare demographics, injury characteristics and hospital outcomes between the two groups. A multivariate logistic regression model was created to assess mortality based on prior trauma literature on mortality risk assessment.

Results: Patients with PSYCH-COMD were more likely to be white women, have a blunt mechanism of injury, and to be less severely injured. After adjusting for predictors of mortality risk based on existing trauma literature as well as controlling for dementia, substance use disorder, and alcohol use disorder separately, PSYCH-COMD was associated with a decreased risk of mortality, longer hospital lengths of stay and increased risk of complications including unplanned ICU admission, unplanned intubation, alcohol withdrawal, and sepsis.

Conclusion: This is the first analysis of clinical outcomes of injured adults with pre-existing PSYCH-COMD using the NTDB. While patients with PSYCH-COMD had decreased risk of mortality, they also had increased risk of complications. Identifying this at-risk population early in their hospital course may facilitate reduced complication rates. Further study is needed to determine the reasons for the disparate outcomes.

BLOOD PRESSURE AT ENDOVASCULAR AORTIC OCCLUSION INITIATION IS ASSOCIATED WITH SURVIVAL IN TRAUMA

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Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a minimally invasive resuscitative maneuver to preserve central blood pressure. The physiologic parameters at which to initiate REBOA treatment in order to improve outcomes are poorly defined. This study examined the impact of systolic blood pressure (SBP) at the time of REBOA procedure initiation on survival.

Methods: The Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) database (October 2013-July 2020) was queried for patients who underwent REBOA. Patients were divided into three groups based on SBP at time of procedure initiation: ≤60mmHg (Group 1), 61-80mmHg (Group 2), and >80mmHg (Group 3). Patients without measurable SBPs at any time were excluded. Data related to demographics, injury severity, treatment, and outcomes were collected. Survival was assessed using Kaplan-Meier log-rank testing.

Results: 333 patients were included (Group 1: n=99; Group 2: n=123; Group 3: n=111). Injury severity scores were similar across groups (p=0.078). Arrival SBP was lowest in Group 1 compared to Groups 2 and 3 (median SBP 90 vs 93 and 108, p=0.003). Group 1 patients were more acidotic, had higher lactic acid and INR levels, and lower base deficit levels (all $p<0.05$). Group 1 patients also received more pRBCs, plasma, and platelets (all $p<0.05$). There were no differences in time to initiation, procedural time, or access technique (all $p>0.05$). Group 1 had the highest in-hospital mortality rate (51.5% vs 42.3% and 30.6% in Groups 2 and 3, respectively; log-rank p=0.007). On logistic regression, SBP at REBOA initiation was not a significant predictor of 24-hour mortality. With the exception of need for patch angioplasty, there were no differences in any procedure-related complications between groups ($p>0.05$).

Conclusion: REBOA procedure initiation at lower SBPs was associated with decreased survival. Increasingly deranged pH and INR levels in this group reflected a diminished physiologic reserve that likely contributed to mortality. Given the similar rates of procedure-related complications regardless of SBP at the time of placement, early initiation of REBOA should be considered.

Poster #43

INCREASED INCIDENCE OF VIOLENT INJURIES AT A LEVEL 1 TRAUMA CENTER FOLLOWING THE POLICE KILLING OF GEORGE FLOYD

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Introduction: Hospital admissions for violent injuries have increased in some US trauma centers during the COVID-19 pandemic. The police killing of George Floyd, which sparked widespread protests and resulted in a national reckoning with racial injustice, is a potential stressor that could explain this increase. In this study, we explored the incidence of violent injuries during the course of the COVID-19 pandemic, paying special attention to the dates of containment policy enactment and the police killing of George Floyd. We hypothesized that violent injuries would increase in response to both events.

Methods: We conducted an interrupted time series analysis for violent injuries between January 1, 2016 and October 29, 2020 at an urban ACS-verified Level 1 Trauma Center. Violent injuries were defined as gunshot wounds, stab wounds, and blunt assaults. The interruption variables of interest were the start of local COVID-19 containment policies (March 16, 2020) and the police killing of George Floyd (May 25, 2020). We assessed temporal associations between these two events and violent injuries using Poisson regression.

Results: There were a total of 5,811 violent injuries during the study period (252 weeks). There was a mean of 22.0 (SD 6.0) violent injury incidences per week in the 229 weeks prior to the killing of George Floyd and a mean of 33.2 (SD 5.8) incidences per week in the 23 weeks after his killing. The result was a 40% increase in violent injury counts per week (incidence rate ratio [IRR] = 1.4; 95%CI: 1.20, 1.64) following the police killing of George Floyd (Figure 1). COVID-19 containment policy enactment was not associated with any change in violent injury incidence (IRR = 0.93; 95%CI: 0.80, 1.08).

Conclusion: Violent injuries significantly increased following the police killing of George Floyd. There was no association between increasing violent injuries and the enactment of COVID-19 containment policies, unlike other studies. Just as hospitals planned for the COVID-19 pandemic, trauma centers should be prepared to respond to higher levels of violent injury during times of social unrest.

Poster #44

OUTCOMES OF REBOA UTILIZATION IN TRAUMA PATIENTS WITH AND WITHOUT TRAUMATIC BRAIN INJURIES: A NATIONAL ANALYSIS OF THE ACS-TQIP DATASET

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Background: Hemorrhage remains a leading cause of death among trauma patients. Resuscitative endovascular balloon occlusion of the aorta (REBOA) has grown in popularity as an efficient, less invasive alternative to managing patients with non-compressible hemorrhage. We aim to investigate the use of REBOA in adult civilian trauma patients with and without concomitant traumatic brain injury (TBI).

Methods: We conducted a secondary analysis of the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) database from years 2015-2017. Adult trauma patients with and without TBI and who had a REBOA placed were included in our analysis. Patients who were deceased on arrival, required resuscitative thoracotomy, or had missing information regarding TBI-status were excluded. Inpatient mortality, complications, and transfusion requirements were assessed based on TBI status.

Results: The ACS-TQIP Database consisted of 2,352,542 patients. Of these, 199 met our criteria for inclusion in our final analysis. REBOA+TBI patients were significantly more likely to have a lower GCS $\leq$8 (82.4% vs 54.4%, $p<0.001$) and systolic BP (89±37.4 vs. 107.2±39.7; $p=0.002$), and higher ISS >25 (83.5% vs 65.8%, $p=0.01$) compared to REBOA/non-TBI patients. No significant differences in odds of inpatient mortality (62.4% vs 50.9%, $p=0.11$) or complications (17.7% vs 11.4%, $p=0.21$) were observed between groups. Odds of inpatient mortality did not significantly differ between patients with and without TBI based on mechanism of injury, Trauma Center level, teaching hospital status, and pelvic fracture status.

Conclusion: TBI status was not associated with higher odds of inpatient mortality in patients receiving REBOA in our investigation.

Poster #45

PREDICTORS OF MORTALITY IN CIRRHOTIC TRAUMA PATIENTS – RESULTS OF ADAPTIVE LASSO REGRESSION ANALYSIS OF TRAUMA QUALITY IMPROVEMENT PROGRAM

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Background: Injured patients with preexisting cirrhosis have high complication and mortality rates. We sought to identify predictors of mortality in cirrhotic injured patients and their association with hemorrhage control interventions.

Methods: We analyzed Trauma Quality Improvement Program (TQIP) 2017 dataset to identify injured patients who were admitted with a history of cirrhosis. We compared patients' demographics, co-morbidities, interventions, and hospital complications between those who died and those who survived. We performed adaptive Lasso regression with cross-validation to identify predictors of mortality. Significance was set at $\alpha=0.05$.

Results: We identified 9,229 trauma patients with preexisting cirrhosis, of those 785 (8.5% died). Patients who died were older (61.1±11.9 vs 57.2±14.7, $p<0.001$), had higher injury severity score (ISS median 18 vs 9, $p<0.001$), and more likely to require hemorrhage control interventions and develop hospital complications. There was no difference in hospital length of stay (LOS), but patients who died had higher median intensive care unit (ICU) LOS (5 vs 3, $p<0.001$). Lasso regression model identified predictors with higher odds of mortality: Age (1.03, 95%CI:1.03 –1.04), ISS (1.09, CI: 1.08-1.11), Glasgow coma scale <8 (5.70, CI:4.24-7.66), any transfusion in the first 24 hours (3.60, CI:2.60-4.99), any intervention for hemorrhage control (2.16, CI:1.06-4.37), pelvic embolization (3.55, CI: 1.11-11.43), development of acute kidney injury (11.09, CI: 6.94-17.71), and unplanned return to ICU (2.59, CI:1.74-3.88). Development of deep venous thrombosis was associated with decreased mortality (OR: 0.14, CI:0.04-0.51). Undergoing gastrointestinal surgery was not associated with mortality in the adjusted model (OR:0.65, CI:0.33-1.25).

Conclusion: High injury severity, hemorrhage requiring transfusion and operative control, and development of acute kidney injury were associated with high mortality among trauma patients with preexisting cirrhosis. Further investigation should explore the interactions between liver disease, hemorrhage, and risk of complications development and mortality.

Poster #46

PREHOSPTIAL PAIN MANAGEMENT IS EFFECTIVE AND SAFE BUT UNDERUTILIZED IN TRAUMA PATIENTS

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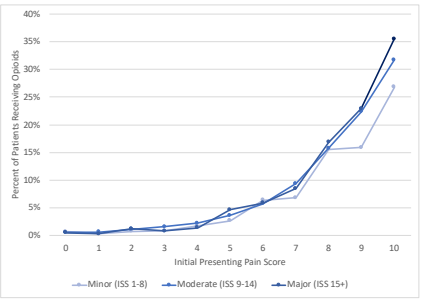
Introduction: Despite concerns about long-term dependence, opioids remain the mainstay of treatment for acute pain from traumatic injuries. Additionally, early pain management has been associated with improved long-term outcomes in injured patients. We sought to identify the patterns of prehospital pain management across the United States.

Methods: We used 2019 national EMS data to identify the use of pain management for acutely injured patients. Opioid specific dosing was calculated in morphine milligram equivalents (ME). The effects of opioids as well as adverse events were identified through objective patient data and structured provider documentation.

Results: We identified a total of 3,831,768 injured patients, 85% of whom were treated by an ALS unit. There were 269,281 (7.0%) patients treated with opioids, including a small number of patients intubated by EMS (n=1,537; 0.6%). The median opioid dose was 10 ME [IQR 5-10] and fentanyl was the most commonly used opioid (88.2%). Patients treated with opioids had higher initial pain scores documented by EMS than those not receiving opioids (8.5 vs 4.4, $p<0.001$), and had a mean reduction in pain score of 2.8 points (SD 2.7) compared to the final prehospital pain score. Adverse events associated with opioid administration, including episodes of altered mental status (n=453; 0.2%) and respiratory compromise (n=252; 0.1%), were rare. For patients with severe pain (≥8/10), 27.3% of patients with major injuries (ISS ≥15) were treated with opioids, compared with 24.8% of those with moderate injuries (ISS 9-14), and 21.4% of those with minor (ISS 1-8) injuries ($p<0.001$).

Conclusion: The use of opioids in the prehospital setting significantly reduced pain among injured patients with few adverse events. Despite its efficacy and safety, the majority of patients with major injuries and severe pain do not receive opioid analgesia in the prehospital setting.



Poster #47

INTRAVENOUS ANTIBIOTICS FOR OPEN FRACTURES WITHIN 1 HOUR OF ARRIVAL: A REALISTIC GOAL?

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Introduction: Open fractures have a high risk of infection. Organizations such as EAST and TQIP have issued guidelines on antibiotic management of patients with open fractures, aiming to minimize this risk.

Methods: This was a retrospective study of adult patients with open long-bone fractures admitted to 6 level 1 trauma centers in 1/1/18-12/31/19. Adherence to antibiotic guidelines was evaluated. Full guideline adherence was defined as receipt of intravenous antibiotics within 1h of arrival (gram+ antibiotics for types I and II open fractures and gram+ and gram- for type III). Partial adherence was defined as receipt of antibiotics within 6h (gram+, type I/II; gram+ and gram-, type III).

Table 1. Adherence to antibiotic administration guidelines

	Full	Partial	None	P
	n=259 (61%)	n=102 (24%)	n=65 (15%)	
Highest grade				**0.04**
I/II (n=226)	134 (59%)	68 (30%)	24 (11%)	
III (n=178)	125 (70%)	34 (19%)	19 (11%)	
Fracture location				
Humerus (n=40)	30 (75%)	7 (18%)	3 (7%)	0.14
Radius (n=84)	47 (56%)	20 (24%)	17 (20%)	0.35
Ulna (n=85)	51 (60%)	19 (22%)	15 (18%)	0.77
Femur (n=101)	61 (60%)	23 (23%)	17 (17%)	0.86
Tibia (n=183)	116 (63%)	45 (25%)	22 (12%)	0.27
Fibula (n=112)	73 (65%)	25 (22%)	14 (13%)	0.50
Fracture number				0.56
Single (n=262)	154 (59%)	66 (25%)	42 (16%)	
Multiple (n=164)	105 (64%)	36 (22%)	23 (14%)	
Washout performed	240 (93%)	97 (95%)	64 (98%)	0.18

Results: The study included 426 patients (Table 1), of which 259 (61%) received antibiotics in full adherence, and 102 (24%) met partial adherence. Patients with more severe open fractures (type III) were more likely to receive fully adherent administration than those with type I or II (P=0.04). Ninety-four percent of patients received wound washout/irrigation, with a median time from arrival to washout of 3h. Seventeen patients (4%) developed open fracture infection, which was not associated with receiving fully, partially, or non-adherent antibiotics (4%, 5%, 3%; P=0.88).

Conclusion: Despite low adherence to full guidelines (61%), 85% of patients received partially guideline-adherent antibiotics, with a low infection rate (4%). These data may suggest that antibiotic administration within 1h of arrival is a challenging task, but even without reaching that goal, overall infection rate remained low, perhaps because other recommendations such as wound washout and irrigation were followed.

Poster #48

OUTCOMES OF CHEST COMPRESSIONS AFTER CARDIAC ARREST IN OCTOGENARIAN AND NONAGENARIAN PATIENTS IN THE SURGICAL INTENSIVE CARE UNIT

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Cedars-Sinai Medical Center

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Introduction: The decision to perform chest compressions in elderly patients in the surgical intensive care unit (SICU) can be challenging due to the uncertainty regarding long term survival. Our aim was to determine the outcomes for patients 80 years and older after chest compressions in the SICU.

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Methods: A retrospective, single institution, observational study was performed at a large, urban, academic medical center from July 2009 to September 2017 of all surgical intensive care patients aged 80 years and older who underwent chest compressions. Additional data collection included a review of achievement of return of spontaneous circulation (ROSC), survival days after chest compressions, and post-arrest morbidity and mortality.

Results: Of the 1918 SICU patients reviewed, 1460 patients were aged 80 to 89 years and 458 aged 90 to 99 years. Of the 1460 octogenarians, 37 patients underwent chest compressions with 17 (62.6%) of those achieving ROSC. The 30-day and in-hospital mortality in this group was 100%. Of the 458 nonagenarians, 18 underwent CPR with 13 (72.2%) of those achieving ROSC. The 30-day mortality in this group was 61.1% with 6 patients surviving beyond 30 days. Among these 6 patients, 5 (83.3%) had prolonged hospital courses with multiple hospital acquired infections, ventilator dependency, and parenteral nutritional support, including 3 (50.0%) patients who also developed chronic renal failure and required hemodialysis. None of these 5 patients survived to discharge. The single survivor was a trauma patient who sustained cardiac arrest due to blunt cardiac injury with no

known comorbid conditions. This patient was discharged 7 days after admission and was then lost to further follow up.

Conclusion: For patients 80 years and older in the SICU who required chest compressions, mortality was nearly 100%. Although some patients obtained ROSC, long term survival was almost zero. Our findings can provide guidance to practitioners when discussing the utility of chest compressions in this population with patients and families.

Poster #49

SHOULD WE PHENOBARB-IT-ALL? A PHENOBARBITAL-BASED PROTOCOL FOR TRAUMA PATIENTS AT HIGH RISK OF OR EXPERIENCING ALCOHOL WITHDRAWAL

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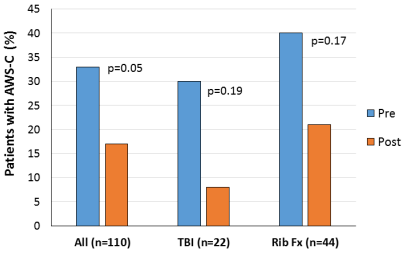
Introduction: Alcohol use is common in trauma patients (pts) and alcohol withdrawal syndrome (AWS) is associated with significant morbidity. Although benzodiazepines (BZD) are commonly used for AWS, they can cause significant side effects including neurologic (CNS) and respiratory depression. Phenobarbital (PHB) has been utilized as an alternative therapy, but data is limited for its use in trauma pts. We hypothesize that a PHB-based protocol is safe and may be more effective than BZDs.

Methods: A retrospective study of adult non-intensive care unit trauma pts at risk of or experiencing AWS before and after implementation of a PHB protocol was conducted. Outcomes evaluated were AWS-related complications (AWS-C), CIWA score > 10, hospital length of stay (HLOS), BZD use, adjunctive medication use, and medication-related adverse events (MRAE). Subgroup analyses were performed on pts with traumatic brain injuries (TBI) and rib fractures (fx).

Results: 110 pts were included, with 51 in the pre-group (PRE) and 59 in the post-group (POST). Seventeen PRE pts developed AWS-C compared to 10 POST pts (33% vs 17%, p=0.05). PRE pts were more likely to receive BZDs (88% vs 42%, p<0.0001) compared to POST pts with only 7% of POST pts receiving BZDs after initiation of PHB. Pts with CIWA scores >10 were reduced in PRE vs POST (84% vs 63%, p=0.01). There were no significant differences in HLOS (11 days vs 8.9 days, p=0.27), adjunctive medication use (49% vs 54%, p=0.60), or MRAE (57% vs 39%, p=0.06) between the PRE and POST groups. There was no significant difference in AWS-C between the PRE and POST TBI and rib fx subgroups with a decrease in CNS depression in POST rib fx pts (55% vs 25%, p=0.04).

Conclusion: A PHB-based protocol in trauma pts is effective in preventing AWS-C, reducing CIWA scores, and decreasing BZD use without an increase in MRAE. Furthermore, PHB appears safe in TBI and rib fx pts without an increase in CNS or respiratory depression.



Poster #50

TOP-DISPO: AN ARTIFICIAL-INTELLIGENCE TOOL AND SMARTPHONE APPLICATION TO PREDICT DISCHARGE DISPOSITION IN TRAUMA PATIENTS

Lydia R. Maurer MD; Sumiran S. Thakur BS; Hamza Tazi Bouardi MS; MBAn; Mohamad El Moheb MD; Annita Vapsi BSc; Leon Naar MD; Anthony Gebran MD; George C. Velmahos MD; PhD; Dimitris Bertsimas PhD; Haytham M.A. Kaafarani MD, MPH
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Introduction: Delays due to discharge planning can increase length of stay (LOS). We aimed to use AI technology to create an early predictor of post-acute care (PAC) needs in trauma patients.

Methods: All patients in the 2010-2016 ACS-TQIP database were included. Demographics, ED vital signs, comorbidities, and injury characteristics (e.g. severity, mechanism) were included in a novel, interpretable AI technology called Optimal Classification Trees (OCTs). An 80:20 train:test split was used to develop predictive OCTs for blunt and penetrating trauma patients for discharge to PAC (e.g. rehabilitation, skilled nursing facility) vs. home. An interactive, user-friendly application was created. C-statistics were used to validate performance.

Results: A total of 870,475 patients were included. The mean age was 51 years, 91% had blunt trauma, and the mean ISS was 15; 325,867 (41%) of the blunt injury patients and 12,254 (15%) of penetrating injury patients were discharged to PAC. Based on the OCT algorithms [Figure 1], the Trauma Outcomes Predictor discharge DISPOsition (TOP-DISPO) phone application was created. TOP-DISPO accurately predicted discharge to PAC in patients with blunt (c-statistics: 0.817 train, 0.815 test) and penetrating (c-statistics: 0.82 train, 0.79 test) injuries [Figure 2].

Conclusions: We recommend TOP-DISPO as an accurate AI-based tool for predicting PAC need in trauma patients. TOP-DISPO could prove useful for early discharge planning and reducing LOS in trauma patients.

Figure 1: Optimal Classification Trees

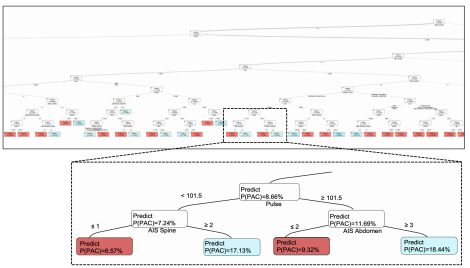
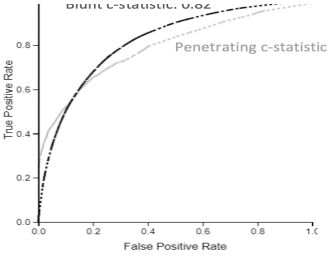


Figure 2: Receiver Operator Characteristic Curves for Test Datasets for Blunt and Penetrating Mechanisms



Poster #51

ASSESSMENT OF MACHINE LEARNING METHODS TO PREDICT MASSIVE BLOOD TRANSFUSION IN TRAUMA

Matt Strickland MD; Anthony Nguyen MEng; Shinyi Wu PhD; Sze-Chuan Suen PhD; Yanda Mu; Brandon Shin; Tej Kalakuntla; Kazuhide Matsushima MD
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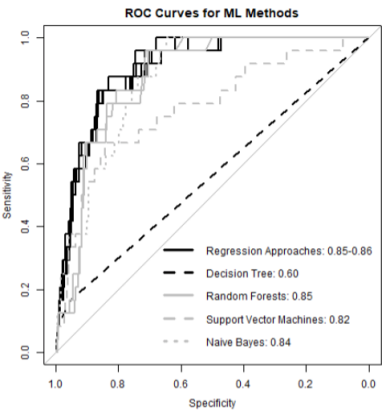
Introduction: Development of predictive models to assess the need for massive transfusion (MT) has been extensively explored. The purpose of this study is to explore the use of modern machine learning (ML) methods to develop and validate a model that can accurately predict the need for MT using a comprehensive set of variables available to physicians at the time of the decision. We hypothesized that a predictive model using ML can predict the need for MT more reliably than currently used scoring systems.

Methods: Trauma patients (≥16 years) who presented to an academic Level 1 trauma center as a trauma team activation between 2015-2019 were included. We explored multiple ML methods including logistic regression with forward and backward selection, logistic regression with lasso and ridge regularization, support vector machines, decision tree, random forest, and naive Bayes. Models are assessed using AUC, sensitivity, specificity, NPV and PPV. Performance was compared to that of existing scores.

Results: 2438 patients are included in the study with approximately 5% receiving MT. All models besides decision tree attained an area under the curve (AUC) of above 0.80 (0.82-0.86). Our regression models have higher sensitivity (0.79-0.83) than the ABC and RABT score (0.47 and 0.45 respectively) while maintaining similar specificity (0.80-0.82; ABC 0.84 and RABT 0.81). Our regression results suggest that SpO_2, respiratory rate (RR), and age may be novel meaningful predictors.

Conclusion: Most of the ML models performed significantly better than existing scores. Patient age, SpO_2, and RR may be important clinical indicators for MT decision. Implementing an ML model in mobile computing devices or EMR-based tool has the potential to improve results. Future research should test feasibility, usability, and acceptability of implementing an ML-informed MT decision support.



Poster #52

CHARACTERIZATION OF PLATELET DYSFUNCTION IN TRAUMATIC BRAIN INJURY

R. Chace Hicks MD; M. Victoria P. Miles MD; Caroline Brown BS; Abigail Edwards BS; Kathryn Stewart RN; Robert Maxwell MD

Introduction: Thromboelastography (TEG) with platelet mapping measures platelet inhibition through the adenosine diphosphate (ADP) and arachidonic acid (AA) pathways. We hypothesized that antiplatelet use, increased head abbreviated injury scale (head AIS), and increased injury severity score (ISS) would increase platelet inhibition measured by TEG in patients with traumatic brain injury (TBI) and predict an increased morbidity and mortality.

Methods: A retrospective review was conducted at a level one trauma center of all patients presenting with TBI from December 2019 to July 2020. A TEG with platelet mapping was performed on TBI patients with intracranial bleed. Patient characteristics, hospitalization data, and laboratory values from presentation were collected and evaluated.

Results: A total of 245 patients were included in the study. For patients with ADP inhibition > 60%, ISS was increased over those who were not inhibited (median 17 versus 13, p=0.0085). An increase in ADP nor AA inhibition was found to be associated with a worsening head AIS (data now shown). Of patients taking antiplatelet medications, the incidence of AA inhibition was greater than ADP (74% versus 26%). Patients with admission platelet count less than 150 were not more likely to demonstrate platelet inhibition (ADP OR 0.74, p=0.8005; AA OR 1.83, p=0.2374). Finally, decreased MA (OR 0.94, p=0.0082) was associated with higher risk of mortality.

Conclusion: Higher ISS is associated with an increase in ADP inhibition in patients with TBI. However, head AIS was not associated with increased incidence of platelet dysfunction (ADP or AA). Therefore, platelet dysfunction does not appear to be associated with worsening brain injury alone. Patients sustaining TBI should have platelet dysfunction assessed with TEG, especially in those taking antiplatelet medication, although the specific relationship between platelet inhibition and degree of injury remains to be determined.

Poster #53

IS THERE HOSPITAL VARIABILITY IN ADMINISTRATION OF BALANCED TRANSFUSIONS TO INJURED PATIENTS? A TQIP ANALYSIS

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Introduction: Annually, trauma leads to 214,000 deaths in the United States. Balanced 1:1:1 transfusion reduces mortality. Given this recent finding and guideline recommendations to provide balanced transfusion during initial trauma resuscitations, we aimed to examine if significant hospital variability existed in administration of balanced transfusion one year following the publication of the PROPPR Trial.

Methods: We performed an observational cohort study of injured patients presenting to Trauma Quality Improvement Program (TQIP) facilities in 2016. Inclusion criteria were patients receiving at least one transfusion of packed red blood cells, fresh frozen plasma, or cryoprecipitate. Hierarchical multivariable logistic regression was used to adjust for patient and hospital characteristics and assess whether there was significant variability in balanced transfusion rates at 4 and 24 hours at the hospital level.

Results: Among the 20,067 patients who received transfusions, 6.5% (1,304) received balanced transfusions in the first 24 hours after arrival to the hospital. Increased odds of balanced transfusion included disposition from the ED to the ICU (OR: 1.40, 95%CI: 1.19-1.64). Patients had lower odds of receiving balanced transfusion if they underwent thoracotomies (0.41, 0.29-0.58) or extremity hemorrhage control (0.50, 0.36-0.69) within the first 24 hours from arrival compared to no hemorrhage control. No hospital level predictors were significantly related to increased or decreased odds of balanced transfusion. 35 hospitals were high outliers (better performing) in administration of balanced transfusion and 4 hospitals were low outliers at 24 hours. 17.8% of variability can be associated to differences between hospitals ($p<0.001$). Attached figure is a caterpillar plot that shows odds of balanced transfusion by hospital at 24 hours.

Conclusion: In 2016, there was significant variability in administration of balanced transfusion between hospitals after controlling for hospital and patient characteristics.

Poster #54

A PILOT STUDY TO EVALUATE THE NEED OF POST-OPERATIVE SYSTEMIC ANTICOAGULATION IN PATIENDS WITH POST TRAUMATIC MEDIUM SIZED PERIPHERAL ARTERY REPAIR: A RANDOMISED CONTROL TRIAL

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INTRODUCTION: Over the past few decades peripheral vascular trauma has emerged as growing concern due to rising number of road traffic injuries, Railway associated injuries and physical assaults which includes firearm and penetrating injuries. There are wide agreement on principles for vascular repair and intra-operative anticoagulation. However, when it comes to postoperative management of vascular trauma, anticoagulation is highly variable in practice amongst surgeons, and there is lack of consensus on its applicability, dose, timing, length of use, efficacy, or adverse effects. The use of systemic anticoagulation to prevent thrombosis is a standard protocol for vascular surgeons during elective repair of blood vessels. However, in the setting of traumatic vascular injuries, concomitant intracranial hemorrhage, soft tissue injury, or solid organ lacerations may preclude its use for vascular repair. A prospective randomized control pilot study was conducted to address the issue of SPAC (systemic post-operative anticoagulation) at a Level-I trauma center. The purpose of this study was to formulate an institutional protocol directing the use of SPAC in medium size arterial repair.

METHODS: The study was conducted in the Division of Trauma Surgery & Critical Care at JPN Apex Trauma Centre, All India Institute of Medical Sciences (AIIMS), New Delhi from Feb. 2019 to August-2020. Total 32 patients were enrolled during time of study period fulfilling inclusion and exclusion criteria. All these patientsreceived intra-operative bolus heparin @ 80 IU/Kg body weight at the point of starting arterial repair. After completion of the primary end to end anastomosis patients were randomized in two groups (Group A and Group B) using sealed envelope method. In post-operative period Group A continued with maintenance intravenous heparin @ 18 IU/Kg body weight for 3 days while Group B did not receive any systemic anticoagulation in postoperative period. Color Doppler evaluation was done to evaluate the vessel patency in post operative period.

RESULTS : The study conducted at our level 1 trauma center ensures comparability among cohorts, received SPAC and without anticoagulation in terms of age in years (mean 30.9 vs. mean 29.7, p=0.918), time of injury-presentation in hours (median 6.5 vs. 5, p=0.560), nature of injury (75% vs. 93.8% were blunt, 25% vs. 6.3% penetrating, p=0.166), crush component (93.8% vs. 75%, p=0.166) associated injuries (37.6% vs. 50%, p=0.506) and severity of injury (MESS: 5.3 vs. 4.5,p=0.072; GHOISS: 4.18 vs. 3.18, p=0.493; ISS: 7.75 vs. 7.06, p=0.504). Our study showed no statistical difference in terms of Vessel patency and limb salvage among the patient received SPAC and without anticoagulation (75% vs. 87.5%, p=0.654) and (87.5% vs. 87.5%, p=0.513) respectively at the time of discharge. However there are significant differences in terms of post operative bleeding/hemorrhage (31.3% vs. 0%, p=0.03), re-exploration rate (37.5% vs. 18.75% p=0.03) and requirement of blood product (50% vs. 12.5%, p=0.04) among SPAC and without anticoagulation cohorts.

CONCLUSION: Post-operative systemic anticoagulation has no benefit in traumatic medium size primary arterial repair of the extremity to improve vessel patency. This study has shown an increase in negative outcomes with anticoagulation use as rise in bleeding tendency, increased rate of re- exploration, more blood products requirements in post-operative periods, increased number of operative procedures and prolong hospital stay. When compared with the upper extremity,limb loss rate is significantly higher in the lower extremity.

Poster #55

INITIAL EMS SHOCK INDEX IS THE MOST ACCURATE PREDICTOR OF PATIENT OUTCOMES

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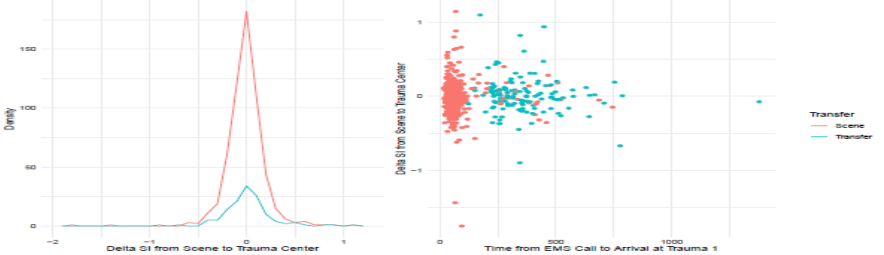
Introduction: Shock index (SI) and delta shock index (ΔSI) predict mortality and blood transfusion. This study aimed to evaluate the predictive ability of SI and ΔSI in a rural environment with prolonged transport times, and transfers from critical access hospitals or level IV trauma centers.

Methods: We completed a retrospective database review at an ACS Level 1 trauma center over 2 years. Adult subjects analyzed sustained blunt chest or abdominal trauma. Subjects with missing data or severe head trauma were excluded. For analysis poisson regression and binomial logistic regression were utilized to study the effect of time in transport and SI/ΔSI on resource utilization and outcomes. $P<0.05$ was considered significant.

Results: Complete data was available on 588 scene patients and 130 transfers. Mean ISS was 11 (IQR9.0) for scene and 13.3 (IQR8.0) for transfers. Initial EMS SI was the most significant predictor for blood transfusion and ICU care in both scene and transferred patients (effect size for blood 5, $p<0.0001$) compared to trauma center arrival SI or transferring center SI. A positive ΔSI was significantly associated with the need for transfusion and the number of units transfused. Longer transport time also had a significant relationship with increasing ICU LOS. Cohorts were analyzed separately. In the scene cohort there was a positive relationship between ΔSI and the need for transfusion and ICU LOS. ΔSI did not have the same effect in transport patients.



Conclusion: Providers must maintain a high level of clinical suspicion for patients who had an initially elevated SI. EMS SI was the greatest predictor of injury and need for resources. Enroute SI and ΔSI were less predictive as time from injury increased. This highlights the improvements in enroute care, but does not eliminate the need for high-level trauma intervention.

Poster #56

IS LOW-TITER GROUP O WHOLE BLOOD TRULY A UNIVERSAL BLOOD PRODUCT?

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McGovern Medical School

Background: Based on AABB guidelines, whole blood (WB) has been historically transfused as a type-specific product. Given recent advocacy for low-titer blood group O WB (LTO-WB) as a potential universal blood product, we sought to examine patient outcomes associated with the use of LTO-WB across various recipient blood groups.

Methods: All trauma patients (16 years and older) receiving prehospital or ED transfusion of LTO-WB (11/17-07/20) were evaluated. Patients were divided into blood groups (O, A, B, AB). Major complications and survival were then compared. Statistical analyses performed using STATA 12.2.

Results:736 patients met inclusion; 368 group O, 236 group A, 101 group B, and 31 group AB. There were no differences in demographics, injury severity, hemolysis panels, or prehospital vitals or resuscitation. However, arrival systolic pressure was lower and lactate worse in blood group B patients (TABLE). While survival and most major complications were similar, acute kidney injury (AKI) was significantly higher among those with blood group B (TABLE). A multivariate model controlling for arrival physiology, lactate, and early transfusions noted group B patients had 2-fold increased likelihood of AKI (OR 2.12, 95% C.I. 1.15-3.90, P=0.015). This analysis was repeated in patients receiving emergency release RBCs and plasma (rather than WB). Group B (15%) was noted to have increased likelihood of AKI compared to other groups (O: 7%, A: 10%, AB: 11%); p=0.041.

Conclusions: LTO-WB appears to be a safe product for universal use across all blood types. While group B recipients experience greater incidence of AKI, this is also observed in patients receiving standard universal products of RBCs and plasma. More research is needed to evaluate the risk of early shock, higher transfusion requirements, and development of AKI among trauma patients with group B blood type.

Poster #57

LOW INITIAL TRAUMA BAY END-TIDAL CARBON DIOXIDE PREDICTS POOR OUTCOMES AND IS A USEFUL ADJUNCT

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WakeMed

Introduction: Appropriate triage of the trauma patient is critical. Low end-tidal carbon dioxide (ETCO2) is associated with mortality and hemorrhagic shock in trauma, but the relationship between low ETCO2 and other important clinical variables is not known. This study investigates the association of initial in-hospital ETCO2 and patient outcomes, as well as the utility of ETCO2 as a predictive aid for early trauma management.

Methods: Adult patients who presented to a Level One trauma center from 2019-2020 were eligible. Trauma bay ETCO2 measured by side stream capnography was prospectively obtained for all trauma activations at time of initial evaluation. Using the Liu method of cut point estimation, patients were stratified as having low ETCO2 (≤29.5 mmHg) or normal ETCO2 (>29.5 mmHg). Multivariable regression was used to estimate association of low ETCO2 with patient outcomes. An unadjusted predictive model for blood transfusion using ETCO2 was then built.

Results: Median time from arrival to ETCO2 measurement was 4 minutes (IQR 3-6). Among 493 admitted patients, 241 (48.9%) had low ETCO2. Compared to patients with normal ETCO2, those with low ETCO2 were older (median age 53 vs 46, p=0.01) and more likely to have the highest trauma activation (27.4% vs 19.8%, p=0.048). There was no difference in head injury. After adjustment, patients with low ETCO2 had greater odds of blood transfusion (OR 4.2, 95%CI 1.8-9.9), mechanical ventilation (OR 2.2, 95%CI 1.1-4.6), inferior disposition (OR 1.6, 95%CI 1.0-2.5), and complications (OR 3.1, 95%CI 1.4-6.8). Among all patients (N=955), the addition of ETCO2 to trauma bay SBP and HR was most predictive of early blood transfusion (area under ROC curve=77.1%).

Conclusion: Low trauma bay ETCO2 remains significantly associated with inferior clinical outcomes after adjustment. Low ETCO2 values, along with vital sign abnormalities, are highly predictive of the need for blood transfusion. Further studies are needed to evaluate the role of ETCO2 as a triage tool for early trauma management.

Poster #58

PERFORMANCE IMPROVEMENT PROGRAM REVIEW OF INSTITUTIONAL MASSIVE TRANSFUSION PROTOCOL ADHERENCE: AN OPPORTUNITY FOR IMPROVEMENT?

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University of Tennessee Health Science Center

Introduction: Much has been written about the impact of massive transfusion protocols (MTPs) on patient outcome. However, little data is available about compliance with established protocols and its impact on outcome. This performance improvement study was undertaken to evaluate institutional adherence with our MTP's intended plasma to red blood cell ratio (FFPR) and platelet to red blood cell ratio (PLTR), and the impact of nonadherence on patient outcomes.

Methods: The registry of an urban Level I trauma center was queried for adult patients who received at least 6 units of packed red blood cells within 4 hours of presentation over a 43-month period; we excluded patients who presented in cardiac arrest or died within 1 hour of presentation. Bivariate and multivariable logistic regression analysis were performed to identify variables associated with noncompliance in FFPR and PLTR in the first 4 hours after presentation, and their effects on inpatient mortality.

Results: 516 patients met study inclusion criteria, with median ISS 25 and inpatient mortality 31.6%. Target FFPR was achieved for 42.8% of patients, and target PLTR for 65.1%. All anatomic and physiologic severity markers were similar between groups. In bivariate analysis, inpatient mortality was not different when FFPR was not achieved (34.6 vs 27.1%, p=.072) but was higher when PLTR was not achieved (39.4% vs 27.1%, p<0.001). After adjusting for age, ISS, Revised Trauma Score, INR, and total blood products transfused, achieving intended FFPR and PLTR in the first 4 hours reduced mortality, OR 0.594 (p=0.044) and 0.313 (p<0.001) respectively.

Conclusion: Large proportions of critically injured patients were transfused fewer units of plasma and platelets than our MTP dictated; failure to achieve intended ratios at 4 hours was strongly associated with inpatient mortality. MTP processes and outcomes should be critically assessed on a regular basis as part of a mature performance improvement program to ensure protocol adherence and optimal patient outcome.

Poster #59

POINT OF CARE TESTING FOR ACIDOSIS AND OUTCOMES IN TRAUMA

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Introduction: Maximized utilization protects scarce resources. Cellular hypoperfusion values guide shock resuscitation. We sought to determine if any or all rapidly available values supported as by the trauma literature reliably predict survival to limit consumption and thereby conserve low reserve assets. A pH of 7.0 defines a "fatal" value.

Methods: Retrospective review of Level 1 activations for pH, lactic acid (LA) and base deficit (BD) from 12/19 -11/20. We recorded age and gender, survival, ISS, and INR, Receiver operator characteristic (ROC) curves were performed using SPSS Version 26. SAS version 9.4 created a logistic regression model.

Results: Of the 573 patients, 117 patients died and there were significant ($p < 0.02$) differences compared to survivors with respect to age, ISS, LA, pH, BD, but not gender. ROC curves for LA and pH were significant (AUC) = 0.69, $p < 0.001$, {95% CI 0.61 – 0.76}; at a LA of 1.85, sensitivity was 80.5% and specificity 33.8%. pH AUC = 0.57, $p = 0.02$, {95% CI 0.51 – 0.64} and at 7.24, sensitivity was 81.7% and specificity 31.4%. In the Logistic Regression, age (OR= 1.06), ISS (OR=1.1), LA (OR=1.7) and INR (OR=36.7) are all associated with an increased risk of death. BD and pH were not. For every 1 point increase in LA, mortality odds increased 74.7%. Only one patient with a pH < 7.0 or lactic acid >19 survived (0.8% survival rate).

Discussion: Resources at many centers are and predicting death early in a resuscitation would conserve resources. Scoring systems are strong predictors, but there is not an ultimate value. Anecdotal reports of survival also invalidate an application of a finite number. We tried to define an easily collected limit defining death-using pH, LA and BD. We found that while sensitive and specific, they are not absolute. While we demonstrate an strong association, a prospective study using these cutoffs would assure death because of lack of intervention. Our next steps are to apply these values to a new dataset of patients to verify validity of pH and LA levels.

Poster #60

REAL TIME DETECTION OF GLYCOCALYX DEGRADATION FOLLOWING TRAUMA: A CONCEPTUAL USE OF THROMBOELASTOGRAPHY

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Introduction: Endothelial injury and glycocalyx (EGX) shedding occur early after trauma hemorrhagic shock (T/HS) and may be key factors in the development of inflammation, coagulopathy and subsequent mortality. Real time detection of EGX degradation is hampered by current methodologies including measurement of EGX degradation products in serum and video microscopy (sublingual microscopy). These methodologies are either not available in real time or used only at trauma centers with specialized expertise. EGX components such as syndecan-1 (syn-1) or heparan sulfate (HS) have been linked with the development of acute traumatic coagulopathy due to their "heparin like" effects. We therefore compared the anticoagulant effect of syn-1 and HS using thromboelastography (TEG) and standard coagulation testing (activated clotting time; ACT) *in vitro.*

Methods: EGX components syn-1 and HS were added to blood samples of healthy volunteers at clinically relevant concentrations. TEG values included R time (clot initiation), K value (clot amplification) and MA (maximum amplitude, overall strength and stability). The heparinase TEG cartridge was used to compare the citrated kaolin R time vs. R time with heparinase to detect a heparin like effect. The ACT test was subsequently performed using the HS blood samples to compare a standard coagulation test with TEG R times.

Results: Mean ± SD (N = 5 for each group)

	Whole blood	Whole blood + HS (35µg/ml)	Whole blood + HS (70µg/ml)	Whole blood + HS (100µg/ml)	Whole blood + Syn-1 (40 ng/ml)
CK R time	6.0 ± 0.7	7.9 ± 0.3*	10.3 ± 1.2*#	11.6 ± 0.5*#	6.4 ± 0.6
CKH R time	6.4 ± 0.3 (Δ 0.4)	5.4 ± 0.5* (Δ 2.5)	5.6 ± 0.2* (Δ 4.7)	5.5 ± 0.3* (Δ 6.1)	5.8 ± 0.6 (Δ 0.6)
MA	57.2 ± 3.3	53.9 ± 4.5	51.4 ± 4.8*	49.3 ± 2.8*	57.7 ± 2.9
Angle	70.1 ± 6.2	65.6 ± 4.2	58.9 ± 3.8*	55.5 ± 4.1*#	70.1 ± 2.5

$p<0.05$ vs. Whole blood, #$p<0.05$ vs. Whole blood + HS (35µg/ml). ACT values were 123 ± 3.3, 132 ± 4.6 and 151 ± 4.2 for whole blood and whole blood + 70 or 100 µg/ml HS ($p< 0.05$ vs. whole blood).

Conclusions: The anticoagulant effect of EGX degradation products were a result of HS in this study. Syn-1 shedding is a useful biomarker for EGX shedding and may have non coagulant effects on the endothelial barrier. The relative R time (citrated kaolin vs. citrated kaolin + heparinase) may be a novel, real time and readily available test to identify EGX degradation in the clinical setting. This may impact future treatment modalities and be predictive of outcome.

Poster #61

DO ALL PATIENTS WITH ACUTE RIB FRACTURES NEED TO BE TRANSFERRED TO A LEVEL 1 TRAUMA CENTER?

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Background: Patients with acute rib fractures are commonly transferred to regional trauma centers (TC). This could impose a strain on tertiary care centers, especially during crises. We hypothesized that a proportion of these transfers are avoidable and sought to identify factors that predict need for transfer to a level 1 TC.

Methods: We analyzed Trauma Quality Improvement Program (TQIP) 2017 dataset to identify adult patients with isolated rib fractures who were transferred to level 1 TC. We defined patients who were considered to benefit from transfer as those who underwent surgical rib fixation, epidural analgesia, or had a length of stay of ≥48 hours (*justified*). Stepwise logistic regression was performed to identify predictors of beneficial transfer.

Results: We identified 2,757 trauma patients with isolated rib fractures who were transferred to level 1 TC. Of those, 1,716 (62.2%) were considered justified. Compared to those who would have not benefited from transfer (*unjustified*), patients in the *justified* group were older (66.3±16.1 vs 58.1±16.7, $p<0.001$), had higher rate of flail chest (4.6% vs 1.6%, $p<0.001$), and a higher risk of requiring ventilator support (6% vs 0.6%, $p<0.001$). Only 2 patients in the *unjustified* group had a reported complication (0.2%). Stepwise logistic regression identified age>45 years, flail chest, history of COPD, heart failure, dementia, or dependent functional status as predictors of *justified* transfer. For every additional predictor, there were 2.05 higher odds of needing transfer to level 1 TC (95%CI: 1.84-2.27). Only 42.6% of those without any of the identified predictors had a *justified* transfer.

Conclusion: Transfer policies for patients with acute isolated rib fractures should strongly consider patient's comorbidities. Avoiding unjustified transfers could decreased the burden on tertiary centers without added risk of negative outcomes, especially during high demand crises.

Poster #62

DOES INTER-FACILITY TRANSFER AFFECT IN-HOSPITAL MORTALITY IN PATIENTS WITH RIB FRACTURES? A RETROSPECTIVE STUDY

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Background: Understanding the risks and benefits associated with inter-facility patient transfers to tertiary care centers is necessary to optimize patient outcomes and resource utilization. We hypothesize that interfacility transfer impacts the outcomes of trauma patients in a rural state, particularly in patients diagnosed with rib fractures. Our primary goal is to determine if inter-hospital transfer is associated with increased mortality in this population.

Methods: We used the institutional trauma registry and enterprise data warehouse to conduct a retrospective review of severely injured patients (ISS>15) with blunt traumatic rib fractures at the only ACS-verified level 1 adult trauma center in a rural state between 2010 and 2019. The key exposure variable was transfer status. The key outcome variables were in-hospital mortality, hospital days, and ICU days. We used multivariable logistic regression for analysis and directed acyclic graphs to identify variables for adjustment.

Results: We identified 1,834 eligible patients with rib fractures, including 796 (43%) who were transferred and 1,038 (57%) were transported directly to our tertiary center. Compared to patients who were transported directly to our facility, those who were transferred were more likely to be white (p<0.001) and to have a lower ISS (22 v. 24; p<0.001). Multivariable regression analysis showed that inter-hospital transfer was not significantly associated with an increase in in-hospital mortality even when accounting for effect size (p=0.07; BF=3.97). The analysis also showed that transfer status had no significant effect on days admitted to the hospital (p=0.93) or days spent in the ICU (p=0.39).

Table 1. Descriptive analysis for demographics and outcomes by transfer status

	Interfacility Transfer (N=796)	**Direct Transport** (N=1038)	P-value
Age*			
18-45	328 (41.2)	510 (49.1)	0.01
46-64	297 (37.3)	360 (34.7)	
65+	171 (21.4)	168 (16.2)	
Mean ± SD	49 (18)	47 (17)	0.002
Gender			
Male	560 (70.4)	750 (72.3)	0.206
Female	236 (29.6)	288 (27.7)	
Race*			
White	669 (84.0)	795 (76.6)	<.0001
Black or African American	86 (10.8)	209 (20.1)	
Others	41 (5.2)	34 (3.3)	
AIS Thorax body region	3 (3, 3)	3 (3, 4)	0.01
ISS	22 (17, 29)	24 (18, 33)	0.02
Total Hospital days	8 (4, 14)	8 (4, 16)	0.161
Total ICU days	3 (0, 7)	3 (0, 8)	0.179
Total Vent days	0 (0, 4)	0 (0, 5)	0.07

AIS: Abbreviated injury score; ISS: Injury severity score; ICU: Intensive care unit; VAP: Ventilator-associated pneumonia; ARDS: Acute respiratory distress syndrome
Results are presented as n (%), mean ± SD, or median (IQR), as appropriate.
*Missing data are not included in the summary.

Conclusion: In trauma patients with rib fractures in a rural state, inter-facility transfer is not associated with an increase in mortality, hospital length of stay, or ICU length of stay. These findings have implications for transfer decision-making within our trauma system.

Poster #63

EVIDENCE OF EARLY CHRONIC VASCULAR INJURY IN A MURINE BLUNT THORACIC TRAUMA MODEL

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Introduction: Previously, in a murine model, we demonstrated that blunt thoracic trauma leads to endothelial activation and pulmonary arterial thrombosis (PAT). Acute management of PAT with therapeutic anti-coagulation remains controversial and is dependent upon factors such as burden and distribution of thrombi as well as risk of additional bleeding from concomitant injury. Long-term potential consequences after PAT are less well studied but potentially include vascular derangement, remodeling, and chronic thromboembolic pulmonary hypertension (CTEPH). We hypothesized that acute blunt thoracic trauma would result in chronic pulmonary arterial injury.

Methods: Adult male C57BL/6 mice were divided into two groups: sham control, and experimental injury using a medium velocity lateral blunt thoracic trauma model. Mice are administered (i.p.) non-reactive IgG_1 at 30 minutes post-injury. At 14 days after initial injury, 5-micron sections of 10% neutral buffered formalin perfused, fixed, paraffin-embedded lungs were stained in hematoxylin and eosin (H&E) or Masson's trichrome, for evaluation of lung alveolar tissue leukocytes /mm and Ashcroft (1988) method fibrosis scoring, or arterial cross section medial thickness and perivascular collagen accumulation, respectively, from ≥10 (200X) images.

Results: At 14 days, median alveolar leukocyte density increased by 20.6% (injury coup) ($p < 0.05$). Fibrosis scores increased on the right side (1.40 vs. 0.65; $p < 0.05$) trending similarly on the left (1.35 vs. 0.65; ns). Arterial perivascular fibrosis (collagen) increased (39.7%; $p < 0.05$) on the contrecoup side only; Medial thickness decreased (10.9% (right), 19.4% (left); $p < 0.05$).

Conclusions: We demonstrate evidence of early chronic pulmonary vascular injury in our murine blunt thoracic trauma model. This finding will enable us to use this model to test therapeutics aimed at preventing or decreasing chronic pulmonary vascular injury after trauma. This model will therefore have clinical relevance for management of potential long-term consequences of blunt trauma such as may be seen in crush injuries, motor vehicle crashes, or blast injuries.

Poster #64

FEMALE SEX INDEPENDENTLY ASSOCIATED WITH REDUCED INPATIENT MORTALITY AFTER ENDOVASCULAR REPAIR OF THORACIC BLUNT AORTIC INJURY

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Objective: Female sex has been associated with increased mortality following blunt chest trauma. Whether sex influences outcomes of thoracic endovascular aortic repair (TEVAR) for traumatic blunt thoracic aortic injury (BTAI) is unknown.

Methods: The Vascular Quality Initiative (VQI) registry was queried from 2013-2020 for patients undergoing TEVAR for BTAI. Univariate Student's t-tests and chi^2 tests were performed, followed by multivariate logistic regression for variables associated with inpatient mortality.

Results: 211 (26.2%) of 806 patients were female. Female patients were older (47.9 vs. 41.8 years, p<0.0001) and less likely to smoke (38.3% vs. 48.2%, p=0.044). Most patients presented with grade III BTAI (53.6% of men, 54.5% of women), followed by grade IV (19.5% men, 19.0% women). Mean Injury Severity Scores (30.5 $\pm$ 18.8 in men, 30.9 $\pm$ 20.3 in women) and regional AIS did not vary by sex. Postoperatively, women were less likely to die as inpatients (7.9% vs. 3.8%, p=0.042) and to be discharged home (41.4% vs. 52.2%, p=0.008).

On multivariate logistic regression (χ^2= 132.97, p<.0001), female sex (OR 0.05, p=0.002) was associated with reduced inpatient mortality. Advanced age (OR 1.06, p< 0.001), postoperative transfusion (OR 1.05, p=0.043), increased Injury Severity Score (OR 1.03, p=0.039), postoperative stroke (OR 9.09, p= 0.016), postoperative myocardial infarction (OR 9.9, p=0.017), and left subclavian coverage (OR 2.7, p= 0.029) were associated with inpatient death.

Conclusion: Female sex is associated with reduced inpatient mortality following TEVAR for BTAI, independent of age, injury severity, BTAI grade, and postoperative complications. Further study of the influence of sex on post-discharge outcomes is needed.

Poster #65

PREDICTORS OF HOSPITAL READMISSION AFTER BLUNT THORACIC TRAUMA

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Introduction: Hospital readmissions are resource intensive, associated with increased morbidity and mortality, and utilized as a hospital level quality indicator. The factors that determine hospital readmission after blunt thoracic trauma are not sufficiently defined. Our group sought to identify predictors of hospital readmission of our patients with thoracic trauma.

Methods: We performed a 10 year (2009-2019) retrospective chart review of blunt thoracic trauma patients at a Level one trauma center who required unplanned readmission within 30 days of hospital discharge. Patient characteristics, injury severity, and hospital complications were examined with quantitative analysis performed to identify readmission risk factors.

Results: There were 13,046 total trauma admissions during the study period. 3,724 patients were admitted for blunt thoracic trauma, with 206 readmitted. The readmission cohort was 68% male, 87% Caucasian, encompassed a variable age range, 16% had a hemothorax, and 45% were admitted to the ICU. On univariate analysis, use of anti-coagulation (11.0 vs 5.4; P:0.029), diagnosis of a mental/psychiatric disorder (10.2 vs 5.3; P: 0.01), and smoking (7.3 vs 5.0; P: 0.008) were predictors of hospital readmission. In addition, fractured ribs >7 (7.5 vs 4.8; P: 0.045), associated hemothorax (8.3 vs 5.2; 0.009), higher abdominal AIS (33.3 vs 8.4 vs 6.5; P: 0.002), rapid response activation (8.9 vs 5.2; P: 0.005), need for ventilator (9.0 vs 5.7; P: 0.001), admission to ICU (7.7 vs 4.5; P 0.001) and diagnosis of in-hospital pneumonia (10.1 vs 5.4; P:0.02) were all predictors of hospital readmission. Cardiac complications (arrythmias, cardiac arrest, and CHF), CAUTI, and VTE complications were not significant risk factors. On multivariate analysis, an associated hemothorax (OR: 1.5; P: 0.071), diagnosis of mental/ psychiatric disorder (OR: 1.9, P: 0.04), presence of smoking (OR:1.6; P: 0.005), higher abdominal AIS (1.5, 0.08), and anticoagulation use (OR: 1.7, P:0.181) predicted hospital readmission.

Conclusions: In blunt thoracic trauma, the injured patient with cognitive impairment, an associated hemothorax, or associated abdominal injuries are most at risk for rehospitalization following discharge. Quality improvement should focus on strategies, and protocols directed towards these groups to reduce non-elective readmission.

Poster #66

PREDICTORS OF READMISSION FOLLOWING TREATMENT FOR TRAUMATIC HEMOTHORAX

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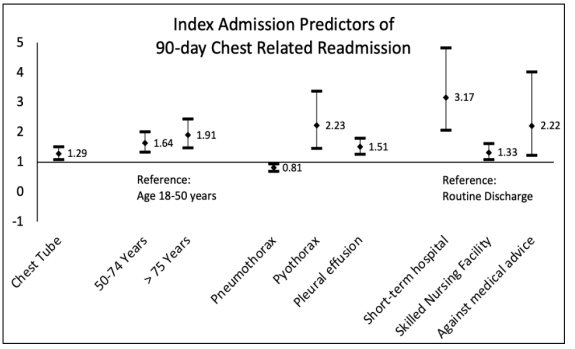
Introduction: The natural history of retained hemothorax is associated with prolonged hospitalization, empyema, pneumonia, readmission and need for additional intervention. We sought to define readmission rates and identify predictors of readmission to reduce patient morbidity.

Methods: The Nationwide Readmission Database for 2017 was queried for patients with an index admission for traumatic hemothorax during the first 9 months of the year. Deaths during the index admission were excluded. Data collected includes demographics, injury mechanism, outcomes and interventions including chest tube, VATS, and thoracotomy. Chest-related readmissions (CRR) were defined as hemothorax, pleural effusion, pyothorax and lung abscess. Univariate and multivariate analysis were used to identify predictors of readmission.

Results: There were 13,903 patients admitted during the study period with a mean age of 54 ± 22, 75.2% were admitted after blunt vs. 18.3% penetrating injury. The overall 90-day readmission rate was 20.8% (n=2890). The 90-day CRR rate was 5.7% (n=794), with 80.5% of these occurring within 30 days. Of all CRR, 62.1% (n=495) required an intervention (chest tube 72.7%, Thoracotomy 26.9%, VATS 0.4%). Mortality for CRR was 6.2%. Index admission predictors for CRR are shown in the figure.



Conclusion: A majority of CRR after traumatic hemothorax occur within 30 days of discharge and frequently require invasive intervention. These findings can be used to improve post discharge follow up and monitoring.

Poster #67

RISK FACTORS OF EMPYEMA IN PENETRATING DIAPHRAGMATIC INJURIES.

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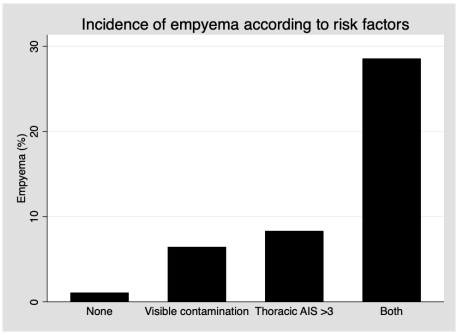
Introduction: Penetrating diaphragmatic injuries are associated with a high incidence of posttraumatic empyema (PE). We analyzed the contribution of trauma severity, specific organ injury, contamination severity, and surgical management to the risk of PE in patients who underwent surgical repair of diaphragmatic injuries at a level 1 trauma center.

Methods: This is a retrospective review of the patients who survived more than 48 hours. Univariate OR calculations were performed to identify potential risk factors. Multiple logistic regression (MLR) was used to calculate adjusted ORs and identify independent risk factors.

Results: We included 192 patients treated from 2011 to 2020. There were 169 (88.0) male. The mean interquartile range, (IQR) of age was 27 (22 - 35) years. Gunshot injuries occurred in 155 subjects (80.7%). Mean (IQR) NISS and ATI were 29 (18 - 44) and 17 (10 - 27), respectively. Thoracic AIS was >3 in 38 patients (19.8%). Hollow viscus was injured in 105 cases (54.7%). Stomach in 65 (33.9%), colon in 52 (27.1%), small bowel in 42 (21.9%), and duodenum in 10 (5.2%). Visible contamination was found in 76 patients (39.6%). Potential thoracic contamination was managed with a chest tube in 128 cases (66.7%), with transdiaphragmatic pleural lavage in 42 (21.9%), and with VATS or thoracotomy in 22 (11.5%). Empyema occurred in 11 patients (5.7%). MLR identified thoracic AIS >3 (OR 6.4, 95% CI 1.77 – 23. 43), and visible contamination (OR 5.13, 95% IC 1.26 – 20.90) as independent risk factors. The individual organ injured or the method used to manage the thoracic contamination did not affect the risk of PE.



Conclusion: The severity of the thoracic injury and the presence of visible abdominal contamination were identified as independent risk factors of empyema after penetrating diaphragmatic trauma.

Poster #68

THE SCAPULA: A MARKER OF INCREASED INJURY SEVERITY AND COMPLICATIONS?

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Introduction: Blunt thoracic trauma comprises 42% of polytraumatic injuries and carries a mortality rate up to 20%. The scapula is considered in the upper extremity abbreviated injury score (AIS), but it constitutes a component of the chest wall. We postulate concomitant scapula and rib fractures infers a higher mechanism of force and leads to worse outcomes.

Methods: A retrospective review of the 2017 National Trauma Database (NTDB) identified 139,857 patients diagnosed with rib fractures, using ICD-10 codes S22-S22.49XS. A subgroup of these patients was identified as having a diagnosed scapula fracture, using ICD-10 codes S42.102S-S42.199S. This created a rib fracture only (RFO) cohort of 129,296 patients and a rib and scapula fracture (RSF) cohort consisting of 10,561 patients. The patients in each group had their data extracted from the NTDB to compare outcomes and injury characteristics. Univariate analysis was performed using Pearson's chi2 and Wilcoxon rank test. Multivariate analysis was performed using a binary logit regression.

Results: The median age in RSF cohort was lower (51[35-62] vs 57[41-70], $p<0.0001$) and tended to be males (78.3% vs 65.4%, $p<0.0001$). Median ICU length of stay (2[0-5] vs 0[0-3], $p<0.0001$), hospital length of stay (6[4-12] vs 5[3-9], $p<0.0001$) and ISS (17[14-24] vs 13[9-18], $p<0.0001$) were all higher in the RSF cohort. The rates of DVT (2% vs 1%, $p<0.0001$), PE (0.9% vs 0.6%, $p<0.0001$), post-admission intubation (3% vs 2%, $p<0.0001$), development of ARDS (1.6 vs 0.7%, $p<0.0001$), CVA (0.8% vs 0.4%, $p<0.0001$), unplanned admission to ICU (3% vs 2.5%, $p=0.0016$), ventilator-associated pneumonia (2.5% vs 1.01%, $p<0.0001$), and death (8.1% vs 6.5%) were higher in the RSF cohort. Comparing discharge disposition, the RSF cohort was more likely to be discharged to inpatient rehab (16.7% vs 12.0%, $p<0.001$) and LTCH (2.5% vs 1.4%, $p<0.001$), whereas the RFO cohort was more likely to be discharged to home (49.8% vs 47.8%, $p<0.001$), home with services (8.0% vs 6.5%, $p<0.001$) and SNF (12.9% vs 9.4%, $p<0.001$). Our binary logit regression demonstrated an increased odds ratio of 1.182 (1.095-1.276) of death in the RSF cohort.

Conclusion: Concomitant scapula and rib fractures led to increased ICU and hospital length of stay, higher rates of complications, and death. These findings suggest this injury pattern demonstrates a higher injury severity and can be a marker for worse outcomes when compared to rib fractures alone.

Poster #69

CHEST X-RAY IS NOT A RELIABLE SCREENING TOOL FOR BLUNT THORACIC AORTIC INJURY

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Introduction: Traditional teaching continues to emphasize the value of initial trauma chest x-ray (CXR) as a screening tool for blunt thoracic aortic injury (BTAI). The hypothesis of the present study is that initial CXR performs poorly in this regard and should not be relied upon to exclude the need for computed tomographic angiography (CTA).

Methods: The AAST / Aortic Trauma Foundation (ATF) prospective BTAI registry was utilized to identify initial CXR findings in patients with a BTAI confirmed on computed tomographic angiography (CTA). Correlation between severity of BTAI, as assessed by Society for Vascular Surgery (SVS) injury grade, and presence of initial CXR findings was undertaken.

Results: From 2015-2021, there were 614 confirmed BTAIs with recorded CXR findings and grading by CTA reported to the ATF. The presence of any of the classic CXR findings was observed in only 50.5% of injuries, with increasing presence correlating with advanced SVS BTAI grade (28.0% G1; 50.6% G2; 58.0% G3; 69.2% G4) [Table 1]. The most consistent single finding identified was widened mediastinum, but this was present in only 27.4% of all confirmed BTAIs and only 47.7% of G4 injuries (7.6% G1, 22.4%, G2, 34.5% G3, 47.7% G4).

Conclusion: CXR is not a reliable screening tool for the detection of BTAI, even at the highest grades of injury. Further investigations of specific high-risk criteria for screening that incorporate imaging, mechanism and physiologic findings are warranted.

	All injuries (N = 614)	SVS Grade 1 (N = 157)	SVS Grade 2 (N = 85)	SVS Grade 3 (N = 307)	SVS Grade 4 (N = 65)
Any classic CXR finding, % (n/N)	50.5% (310/614)	28.0% (44/157)	50.6% (43/85)	58.0% (178/307)	69.2% (45/65)
Widened mediastinum	27.4% (168/614)	7.6% (12/157)	22.4% (19/85)	34.5% (106/307)	47.7% (31/65)
Left hemothorax	12.7% (78/614)	3.2% (5/157)	15.3% (13/85)	14.7% (45/307)	23.1% (15/65)
Clavicular fracture	6.7% (41/614)	5.7% (9/157)	5.9% (5/85)	7.8% (23/307)	4.6% (3/65)
Sternal fracture	2.6% (16/614)	2.5% (4/157)	1.2% (1/85)	2.3% (7/307)	6.2% (4/65)
Multiple left-sided rib fractures	2.6% (16/614)	2.5% (4/157)	1.2% (1/85)	2.3% (7/307)	6.2% (4/65)
Apical cap	1.3% (8/614)	0% (0/157)	2.4% (2/85)	2.0% (6/307)	0% (0/65)
Scapular fracture	4.1% (25/614)	5.1% (8/157)	1.2% (1/85)	3.9% (12/307)	6.2% (4/65)
Deviated trachea or nasogastric tube	3.4% (21/614)	0.6% (1/157)	1.2% (1/85)	4.9% (15/307)	6.2% (4/65)
Loss of AP window	0.7% (4/614)	0.6% (1/157)	0% (0/85)	1.0% (3/307)	0% (0/65)

Poster #70

RIGID PLATE FIXATION FOR CLOSURE OF DAMAGE CONTROL STERNOTOMIES

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Introduction: Rigid plate fixation of the sternum may have advantages in certain cardiac patients at high risk for sternal wound infections and malunion. Due to its ease of use, it may provide advantages for trauma surgeons performing damage control sternotomy.

Methods: We performed a retrospective cohort study of all patients who underwent emergent sternotomy from 1/1/2018-1/31/2021. Outcomes in patients closed with wire cerclage group (WC) were compared to patients who underwent rigid plate fixation (RPF).

Results: Twenty-two patients underwent emergent sternotomy. All sternotomies were performed and closed by trauma surgeons. There were 11 patients in each group (WC vs. RPF). There was no significant difference in admission demographics, ISS or admission characteristics between the two groups. While ICU and hospital length of stay were not significantly different, patients who underwent RPF vs. WC had significantly fewer ventilator days (2.5 ± 4.1 vs 14.3 ± 18.1, $p = 0.04$). All patients survived to discharge. Complication rates were not significantly different.

Discussion: This is the first study comparing RPF and WC for sternotomy closure in the setting of trauma. Our study suggests there is a significant improvement in ventilator days as well as a trend towards improved length of stay in trauma patients. RPF is safe and technically easy to perform which may make it a superior method for closure in patients undergoing damage control sternotomy.

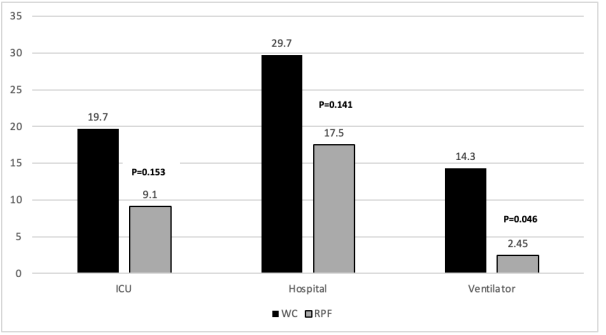

Figure: ICU length of stay (days), Hospital length of stay (days) and Ventilator days in patients undergoing Wire Cerclage (WC) versus Rigid Plate Fixation (RPF)

Poster #71

DEMOGRAPHIC AND HOSPITAL FEATURES OF FIREARM INJURY VICTIMS CAN DIRECT INTERVENTION SERVICES

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Introduction: Firearm injury recidivism represents a failure of the medical system to identify and provide intervention services to patients who present with an index firearm injury. However, with over 100,000 firearm injuries annually in the US, it is not feasible or cost effective to provide intervention services to all victims. Identification of those likely to become recidivists can help direct intervention services to a high-risk population.

Methods: A retrospective review of the trauma registry and of the local police death records of 7 geographically disparate, high volume, level 1 trauma centers was completed from 2000-2019. Recidivists were identified as any patient presenting twice with firearm injury or presenting once and dying at a second incident. Descriptive statistics and T-tests identified groups who are at higher risk on initial presentation at index injury.

Results: 31,522 patient records were reviewed, 4437 of whom died at index injury, leaving 27,115 at risk of recidivism. 947 (3.5%) became recidivists, with recidivism rate by center ranging from 0.5% to 6.3%. At index injury, those who go on to become recidivists are more likely to be young, (23.8 vs 28.5 years; $p<0.05$), male (97.7% vs 85.5%; $P<0.05$), and African American (92% vs 56%, $p<0.05$). Future recidivists have a lower ISS (8.9 vs 10.5, $p<0.05$), shorter hospital length of stay (5.5 vs. 10 days, $p<0.05$), and are more likely to have been treated and released from the emergency department (41% vs. 17% $p<0.05$). The median time to second injury was 693 days (1.89 years) and the mortality rate for recidivists at second injury is higher (0.18 vs 0.14, $P<0.05$).

Conclusion: Although urban firearm injury affects many individuals, those who go on to a second injury fit a narrow demographic profile of being young, African American males who have short hospitalizations or are treated and released from the emergency department. Targeted intervention programs for firearm injury recidivism should be directed at this demographic for maximal efficacy and cost-effectiveness.

Poster #72

DOES IMPROVED URBAN UNDERTRIAGE CONFER A SURVIVAL DISADVANTAGE?

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Introduction: The appropriate and expeditious triage of critically injured trauma patients to accredited trauma centers within established trauma systems is vital for improved patient survival. The purpose of this investigation was to characterize and compare undertriage within urban and rural segments of Pennsylvania's statewide trauma system. We hypothesized that undertriage would be significantly lower and outcomes significantly improved in urban sectors compared to rural counterparts.

Methods: The Pennsylvania Trauma Outcome Study was retrospectively queried from 2003-2017. All adult (age ≥15) trauma admissions with valid county of injury code data were extracted. Undertriage was defined as a trauma patient with an Injury Severity Score (ISS) ≥15 not being triaged as a trauma team activation. Rates of undertriage and patient characteristics were compared between urban (county code pop. ≥284 persons per square mile) and rural segments. Multilevel mixed-effects logistic regression modeling, controlling for age, ISS, SBP, motor GCS, and penetrating injury mechanism and adjusted for clustering of case volume, was used to assess adjusted rates of undertriage and mortality between subgroups.

Results: 455,222 trauma patients met inclusion criteria, of which 70.3% (n=320,095) were urban and 29.7% (n=135,127) were rural. Overall undertriage rate was 8.85% (n=40,305) and was significantly lower in urban sectors in unadjusted analysis (urban: 8.69%, rural: 9.24%; $p<0.001$). Penetrating injury mechanism (urban: 9.73%, rural: 4.45%, $p<0.001$) and dead on arrival/death in the ED (urban: 1.71%, rural: 0.58%, $p<0.001$) were more prevalent in the urban patient population. In multilevel modeling, urban designation remained significantly associated with decreased rates of undertriage (AOR: 0.90, 95%CI: 0.86-0.95; $p<0.001$), with higher rates of mortality (AOR: 1.32, 95%CI: 1.25-1.40; $p<0.001$).

Conclusion: Patients presenting in urban segments of Pennsylvania's mature trauma system have lower rates of undertriage, but higher rates of mortality compared to rural counterparts. The lower rate of undertriage seen in urban settings is related to a frameshift of the place of death from the field to the ED associated with presumed improved and expeditious urban prehospital care.

Poster #73

NATIONWIDE ANALYSIS OF THE DISTRIBUTION OF ACS-COT VERIFIED LEVEL 1 AND LEVEL 2 TRAUMA CENTERS AND POPULATION GROWTH UTILIZING GIS MAPPING TECHNOLOGY

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Background: Trauma centers decrease injury mortality and improve patient outcomes. Few investigations detail the nationwide geographical distribution of ACSCOT-verified L1TCs and L2TCs with respect to MVC-related injuries/fatalities. We aim to utilize GIS mapping to investigate the nationwide distribution of L1TCs and L2TCs in relation to motor vehicle collision (MVC)-related injuries at the county level, to determine if heavily burdened counties experienced appropriate trauma coverage.

Methods: Retrospective Cohort analysis of ACSCOT-verified L1TCs and L2TCs, US Census Bureau, and NHTSA Fatality and Injury Reporting System Tool database from 2010-2018.

Results: 198 ACSCOT L1TCs across 41 states and 124 counties and 215 L2TCs across 39 states and 151 counties were identified. The L1TCs were comprised of 107 adult L1TCs, 29 adult/pediatric L1TCs, 31 level 1 adult/level 2 pediatric TCs, and 31 pediatric L1TCs with a mean distance of 1,104 miles between L1TCs. In contrast, L2TCs included 197 level 2 trauma centers, 12 level 2 adult/level 2 pediatric trauma centers, and 6 level 2 pediatric trauma centers with a mean distance of 1160 miles between L2TCs. The Southern and Western US has the greatest number of L1TC and L2TCs, respectively. The majority of ACSCOT TCs are located in metropolitan and urbanized areas. 21/103 counties (20.4%) containing only one L1TC and 13/151 counties (8.6%) containing only one ACSCOT-verified L2TC experienced upward trends in population size, upward trends in MVC-related injuries, and upward trends MVC-related fatalities from 2010-2018.

Conclusions: One-fifth of US counties containing an ACSCOT-verified Level 1 and nearly nine-percent of counties containing an ACSCOT-verified Level 2 Trauma Centers experienced increased population size, increased MVC-related injuries and increased fatalities from 2010-2018. Revision of state limitations regarding the distribution of ACSCOT-verified Level 1 and Level 2 Trauma Centers, frequent evaluation of local community need, and more widespread establishment of ACSCOT-verified level 1 and level 2 TCs may improve patient outcomes for heavily burdened counties.

Poster #74

OPTIMAL TIME FOR IMPLEMENTATION OF ADVANCED RESUSCITATIVE CARE: A TQIP REVIEW OF EMS CONTACT TIME AND MORTALITY

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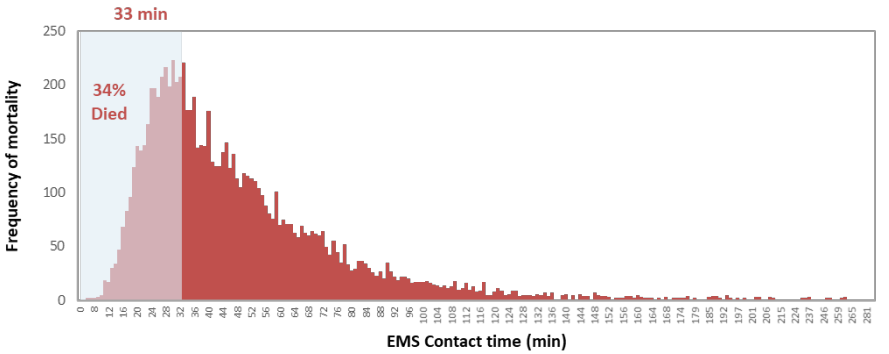
Introduction: In patients with non-compressible truncal hemorrhage (NCTH) mortality occurs within the first 15-30 minutes. The military codified the use of whole blood and REBOA as Advanced Resuscitative Care (ARC) interventions in NCTH. We aim to identify the optimal EMS contact time for implementation of pre-hospital ARC.

Methods: The TQIP database (2012-2017) was utilized to identify hypotensive patients with SBP ≤ 90 mm on the scene. EMS contact time was defined as time of EMS on the scene plus transport time to ED. Decision Tree and Receiver Operating Characteristic analyses were employed to identify optimal EMS contact time for ARC interventions.

Results: 6,434 trauma patients were hypotensive at the scene with overall mortality of 25.3% (n= 1,672). EMS contact time was shorter for patients that survived compared to those that died (28 minutes vs. 30 minutes, p<0.001). The optimal cutoff EMS contact time was 33 minutes with 34% of mortalities occurring before that time and 66% of deaths occurring at 33 minutes or greater of EMS contact time.



Conclusion: This is the first analysis on optimal EMS contact time for meaningful application of ARC. Implementation of ARC within the first 33 minutes of EMS contact time can potentially decrease prehospital mortality by a third. Prospective validation is needed.

Poster #75

THE COVID-19 PANDEMIC AND ITS IMPACT ON MASS SHOOTINGS IN SIX MAJOR US CITIES

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Introduction: The COVID-19 pandemic has significant impacts on the US socioeconomic structure. Gun violence is a major public health issue and the effects on this area have not been well-elucidated. The objective of this study was to determine the impacts of the pandemic on mass shootings in six major United States cities with historically high rates of gun violence.

Methods: Mass shooting data were extracted from an open-source database, Gun Violence Archive. Mass shooting was defined as 4 or more people shot at a single event. Six cities with the highest incidence of mass shootings were analyzed (Chicago, Baltimore, New Orleans, Detroit, Philadelphia, St. Louis). A map was created using ArcGIS.

Results: In 2020, the overall percentage of mass shootings increased by 46.7%. In the six cities analyzed, the total proportion of mass shooting events was unchanged (n=91/417, 21.8% vs n=126/611, 20.6%, p=0.64). Chicago, the US city with the highest incidence of mass shootings, did not experience a significant change in 2020 (n=34/91, 37.3% vs. n=53/126, 42.1%, p=0.57). Baltimore had a significant decrease in mass shooting events (n=18/91, 19.8% vs. 10/126, 7.9%, p=0.01). The other four cities had no significant change in the number of mass shootings (p>0.05).

Conclusion: This study demonstrated that while some types of gun violence shifted during the COVID-19 pandemic, the number of mass shootings in six US cities remained largely unchanged. Future studies should focus on the changing patterns of homicides in high-risk communities and other possible influencers such as gang-related violence and drug trafficking.

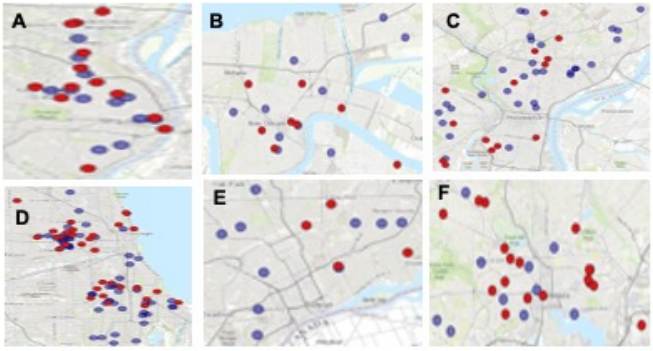

Figure 1. Maps generated from ArcGIS comparing mass shooting events from 2019 (red) and 2020 (purple) for six major US cities: A. St. Louis, B. New Orleans, C. Philadelphia, D. Chicago, E. Detroit F. Baltimore

Poster #76

THE IMPACT OF MARITIME DEPLOYMENTS ON THE SURGEON'S PRACTICE

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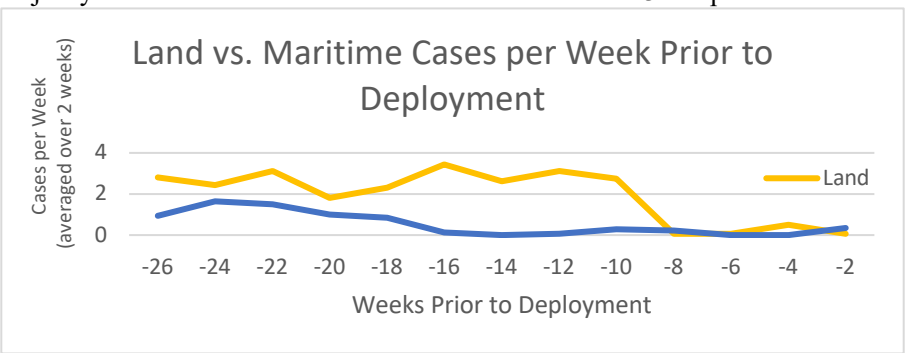
Introduction: The U.S. Navy routinely deploys 10 aircraft carriers and 9 amphibious assault ships throughout the world in support of U.S strategic interests, each with an embarked surgical team. Surgeons are required to participate in lengthy pre-deployment shipboard certifications prior to each deployment. Given the well-established relationship of surgeon volume to patient outcome, we aim to compare the impact of land versus maritime deployments on Navy general surgeon practice patterns.

Methods: Case logs and pre-deployment training initiation of land (n=8) vs. maritime-based (n=7) U.S. Navy general surgeons over a three year period (2017-2020) were compared. Average cases per week were plotted over 26 weeks prior to deployment. Student's t-test was utilized for all comparisons.

Results: Six months prior to deployment, maritime surgeons performed an average of 14 vs 50.3 cases (p=0.009). At 16 weeks, this difference persisted (2.1 vs 25.3 cases, p=0.003). These differences resolved in the 8 to 2 weeks pre-deployment time period when land deploying surgeons commenced pre-deployment training. While deployed, maritime surgeons performed 0.6 vs 1.5 (p=0.081) cases per week compared to land-based surgeons. However, the majority of these cases were at the robust Kandahar Role 3 Hospital.



Conclusion: The surgeon is a critical component of the combat causality care team. In this initial analysis, we have demonstrated that shipboard surgeons have prolonged periods away from clinical care compared to their land based colleagues. This prolonged pre-deployment deficit in surgical volume may negatively impact patient outcomes in the deployed maritime environment.

Poster #77

THE IMPACT OF MODE AND TIME OF EMS TRANSPORT ON TRAUMATIC DEAD ON ARRIVAL PATIENTS TRANSPORTED TO ACS-VERIFIED TRAUMA CENTERS

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Background*:* As of 2019, unintentional injury remains the leading cause of death for individuals up the age of 44 and is the third overall leading cause of death across all ages. Motor vehicle collisions are responsible for a significant proportion of these deaths and inflict significant financial burdens on the economy. Although multiple studies emphasize the significance of ISS and transport times to predict patient outcomes, little emphasis is placed on patients who are dead on arrival (DOA). We aim to assess the impact of mode of transport and time of transport on DOA or trauma patient survivability, according to the level of trauma center destination.

Methods: This retrospective study utilized the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) PUF datafile to examine the mode of transport and time of transport of adult patients who were DOA. This study only considered direct admissions and did not examine DOA patients with documented interfacility transfer. DOA was defined according to the ACS-TQIP datapoint, "arrived with no signs of life and did not recover". AIS score >9 was collected/reported to adjust for ISS scores that may have changed at autopsy. Patients were subdivided into 3 groups based on injury classification – low (ISS <15), intermediate (ISS 15-24), and severe (ISS ≥25). Each group was subsequently categorized by the mechanism of injury (blunt vs. penetrating), mode of transportation (ground vs. air), time of transport, and level of trauma center destination. The primary outcome of our study was to investigate the prevalence of DOA patients according to mode of transportation, time of transport, and trauma center level in relation to trauma patient survivability. Statistical analysis was performed by IBM SPSS Statistics v26.0 (Armonk, NY) and significance was defined as $p<0.05$.

Results: The majority of DOA patients suffered from blunt injuries and comprised larger proportions than their counterparts with penetrating injuries in all ISS groups. Intermediate ISS DOA patients demonstrated the least mortalities. Air transport was longer than their ground transport counterparts across all ISS groups. The number of DOA patients was low when transported within 15 minutes. Ground EMS transport time varied significantly across ISS groups for patients transported to any ACS-verified trauma center level. Air EMS transport times were only significantly different between ISS groups when transported to a level 1 trauma center. DOA patients transported by ground EMS decreased across all ISS groups when comparing those transported within 16-30 minutes vs. those arriving within 31-45 minutes and decrease thereafter. The majority of patients who were deemed DOA were transported within 45 and 75 minutes via ground and air transport, respectively. Patients who traveled by helicopter experienced less deaths than those traveling by ground despite longer transportation times.

Conclusion: Patients who were transported within 15 minutes experienced fewer deaths across all injuries, mode of transportation, and ISS groups. The number of DOA patients transported by ground EMS decreased as transport time increased. Intermediate ISS groups display lower rates of mortality compared to their low or severe ISS counterparts among all modes of transportation, EMS transport time, and trauma center level, except those with blunt injuries with air transport to a level 3 trauma center. Despite lower mortality in the intermediate ISS group, the median EMS transport time of this group was not significantly longer than the other ISS groups. Future studies should investigate the prevalence of DOA patients with intermediate ISS and assess DOA and mode of transport of patients with record of interfacility transfer.

Poster #78

THE UNTOLD AND UNCOUNTED SEQUELAE NEUROLOGIC FIREARM INJURY

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Introduction: Gunshot wound (GSW) mortality data count those who die at the index event and not those die prematurely as a sequelae of firearm injury. The aim of this study was to describe disability and late mortality from neurologic GSW injury and quantify the burden to the healthcare system.

Methods: This is a retrospective series of patients between 2000-2015 surviving a GSW to the brain or spinal cord. Social Security Death index and national obituary registry identified subjects date of death. Regional healthcare exchange records were reviewed, for number and primary diagnoses of subsequent hospital admissions and emergency department (ED) encounters.

Results: 159 patients met inclusion criteria: 73 brain (BI) and 86 spinal cord injuries (SCI). Median age was 27 years, 80% black, 92% male. Initial admission accounted for 3922 hospital days with a median stay of 13 days for BI and 18 for SCI patients. 20 BI and 32 SCI patients were lost to follow up but presumed alive. 20 (13%) patients (9 BI, 11 SCI) died. Average time to death was similar for BI and SCI (1091 and 1097 days). Neurologic GSWs accounted for 1,226 premature years of life, representing a willingness to pay estimate of over $122 Billion of economic loss. The remaining 106 patients accounted for 745 encounters, (200 admissions, 545 ED visits). BI patients presented with neurological complaints and skin and soft tissue infections, compared to urinary infection and decubiti issues in SI patients.

Conclusion: Late sequelae and death resulting from neurologic injury from GSW are poorly captured in public health data. These patients experience significant health care problems, and become significant users of the “ED” health care system. Data surveillance systems and better long term follow-up for these patients need to be developed to accurately capture this health care burden, decrease costs, and improve overall outcomes.

Poster #79

TRAUMA RESEARCH PROGRAMS OF ACADEMIC AND NON-ACADEMIC HOSPITALS: ON EQUAL FOOTING?

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Introduction: American College of Surgeons level 1 trauma center verification requires an active research program. This study investigated differences in the trauma research programs of academic and non-academic ACS-verified level 1 trauma centers.

Methods: A 28-question survey was administered to all 175 ACS-verified level 1 trauma centers nationwide in 11/12/2020-1/11/2021. The survey included questions on center characteristics (patient volume, staff size), peer-reviewed publications, staff and resources dedicated to research, and funding sources.

Results: The survey had a 31% response rate (42 responses to 137 successful invitations), with 36 (86%) academic and 6 (14%) non-academic centers responding. Academic and non-academic centers reported similar median annual trauma patient volume (2,190 vs. 2,450), number of beds (545 vs. 440), and years as an ACS-verified level 1 center (20 vs. 14), respectively. Academic centers had significantly more full-time trauma surgeons (median 8 vs 6 for non-academic centers) and general surgery residents (median 30 vs 7). A greater percentage of academic centers had biostatisticians (65% vs 50%), basic scientists (35% vs 17%), dedicated lab space (25% vs 17%), and student employees or volunteers (70% vs 50%) available when conducting trauma research. Non-academic centers more frequently ranked trauma surgery (100% vs. 36% academic), basic science (50% vs. 6% academic), neurosurgery (50% vs. 14% academic), and nursing (33% vs. 0% academic) in the top three types of studies conducted. More academic centers reported using the traditional 20-publication route to fulfill ACS research criteria (74% vs 67%). Academic centers were more likely to report non-profit status (86% academic, 50% non-academic) and utilized research funding from external governmental/non-profit grants more often (76% vs 17%).

Conclusion: Survey results suggest that academic centers may have more staff and financial resources available to dedicate to trauma research, which may make fulfillment of ACS level 1 research requirements easier for these centers. This could potentially lead to overrepresentation of academic centers among ACS-verified level 1 trauma centers in the United States, suggesting that non-academic trauma centers may benefit from increased resources devoted to and prioritization of trauma research.

Poster #80

UNDERSTANDING OBSTACLES TO EFFICIENT TRANSFER OF TRAUMA PATIENTS: AN EVALUATION OF RE-TRIAGE PROCESSES FROM LOW-LEVEL TRAUMA CENTERS

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Northwestern University

Introduction: Under-triage of severely injured patients is associated with higher mortality. Nonetheless, 30-50% of severely injured under-triaged patients are never re-triaged to high-level trauma centers. We sought to identify barriers or failures in the re-triage process among low-level trauma centers in a 9-hospital health care system.

Methods: We conducted a Failure Modes Effects and Criticality Analysis of five low-level trauma centers in a single health care system. We leveraged a Learning Collaborative framework to create a process map of the trauma assessment and re-triage process with guidance from 27 trauma surgeons, emergency medicine physicians, trauma nurses and coordinators working at one of the five low-level trauma centers. Participants identified failures during each step in the process and rated each failure 1-10 on impact, frequency, and detection safeguards to generate a risk table of failures in the re-triage process and calculate each failure's Risk Priority Number (RPN).

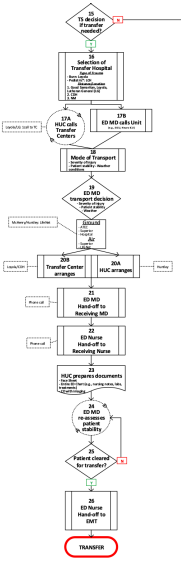

Figure 1: Patient Transfer Map

Results: A re-triage process map (Figure 1) was generated and consisted of 26 steps, where 91 failures in the re-triage process were identified. The most impactful failures were (1) patient decompensates after seeming stable, (2) difficult airway, and (3) insufficient providers for critical procedures. The most frequent failures were (1) re-triage requiring conference with receiving MD, (2) delay in consultant calling back, and (3) trauma team interruptions during EMS bedside handoff. The failures with the least safeguards for detection were (1) patient injury under-categorized after initial review, (2) transfer center does not call back, and (3) weather change prevents air transport after arrangements have been made. The three most critical failures in the re-triage process were: (1) delay in consultant calling back (RPN=232), (2) difficult airway (210), and (3) critical care transport cannot be obtained (200).

Conclusions: Failures in consultant call back and critical care transport are modifiable processes that present opportunities for interventions which could increase timely re-triage of injured patients to high level trauma centers.

Poster #81

CLUSTER ANALYSIS OF HOSPITALS BY FEATURES OF ORTHOPEDIC CARE IN AN INCLUSIVE TRAUMA SYSTEM

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Harborview Medical Center

Introduction: While criteria for different levels of trauma center (TC) verification are clear, few studies have evaluated the real-life variability in trauma care provided by different level TCs. As orthopedics is a key component of trauma care, we evaluated if hospitals clustered by features including volume and type of orthopedic procedures aligned with TC level.

Methods: We conducted a cluster analysis with state hospital discharge data from 2016. We included all hospitals, regardless of TC designation, and all major orthopedic procedures. Patient and hospital factors (Table) were analyzed in a principal component analysis. This reduced the feature space dimensionality from 2,770 to 16 components that accounted for 90% of the variation. We identified clusters on key features and determined if clusters aligned with TC designation.

Results: The key features of the six clusters are summarized in the table. Unsupervised learning separated hospitals by multiple feature similarity which only partially aligned with TC designations. Of all major orthopedic procedures (MOP), knee replacements in non-trauma patients, and humeral, radial and tibial fixations in the trauma patients had the greatest contribution to cluster assignments.

Conclusions: Unsupervised learning can generate meaningful clusters of TCs and non-TCs in a mature trauma system that identify key features beyond designation level that group clinical orthopedic trauma care. This is a promising first step in developing complex optimization models for mature trauma systems.

Selected key features of hospital clusters[a]

Cluster	# of each TC level	% Trauma transfer	% trauma admission	% ISS >15	% Male	# MOP for trauma	% Private insurance	Age (yrs)
1	I (1/1)	51	38	21	64	5088	29	53
2	II (5/6),III (6/24) IV (1/35), Non (4/15)	12	5	13	44	554	40	55
3	II (1/6),III (14/24) IV (16/35), V (2/14)	2	5	4	43	156	27	60
4	IV (1/35), Non (2/15)	0	2	0	59	1	47	64
5	IV (6/35)	1	3	8	37	8	16	34
6	III (4/24), IV (4/35), Non (1/15)	1	4	5	36	159	48	37

a. Variables not listed in table: Median ISS, % trauma transferred out, % non-trauma transferred in, % non-trauma transferred out, % low-income payor, % blunt, % penetrating, % burn, % of all major procedures that were MPO, # MOP for non-trauma, % of each MOP of all hospital MOPs in trauma, % of each MOP of all hospital MOPs in non-trauma

Poster #82

THE CANADIAN IMPACT OF COVID-19 ON SEVERE INJURIES FROM INTENTIONAL, UNINTENTIONAL AND SUICIDE CAUSES.

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University of Calgary

Introduction: The impact of COVID-19 on trauma epidemiology amongst the Canadian population is likely distinct from that within the United States. Differential realities include: universal health care coverage, a narrower socioeconomic spectrum, and more limited access to firearms. The primary aim was to evaluate the impact of COVID-19 on Canadians following unintentional injuries, intentional violence, and suicide attempts.

Methods: All severely injured (ISS$\geq$12) patients who presented to a level-1 trauma center for 3 months following the declaration of a public health emergency (March 15, 2020) were analyzed. These patients were date/volume matched to the previous year ($p<0.05$ = significant).

Results: 357 severely injured patients from each of the pre- and post-COVID-19 eras were compared. Median patient age (50.1 vs. 52.3 years; p=0.493), ISS (19 vs. 18; p=0.322) and hemodynamic instability at presentation remained static. The number of severely injured female patients decreased (29.1% vs. 21.0%; p=0.012). Although fewer overall ED visits, similar severe injury patient admissions (373 vs. 357 over the same preceding year's dates) were noted. While the overall number of severe injuries following motor vehicle crashes and intentional violence (blunt assaults, stabbings, gunshots; 21.3% vs. 22.7%; p=0.651) remained stable, the mechanistic composition changed substantially. Blunt assaults decreased (7.3% vs. 3.4%; p=0.020), while penetrating violence escalated (14.0% vs. 19.6%; p=0.045). The increase in penetrating trauma was due to an increase in gunshot wounds (16.0% of penetrating mechanisms vs. 32.9%; p=0.0059). Suicide attempts leading to severe injury in the initial COVID-19 era was static (4.8% vs. 6.2%; p=0.410). The number of women severely injured via assault decreased (5.6% vs. 0.84%; p=0.003), while the number of severe injuries from suicide attempts was unchanged (4.8% vs. 6.2%; p=0.410). Amongst assaults directed towards females, both blunt (2.0% vs. 0.2%; p=0.033) and penetrating (3.6% vs. 0.80%; p=0.012) decreased.

Conclusion: Canadian trauma epidemiology within the initial COVID-19 era is different from both regions within the United States and globally. Intentional gun violence increased despite stable overall trauma admissions, suicide attempts, and a decrease in female-associated severe injuries.

Poster #83

GUN SHOWS AND BACKGROUND CHECK LAWS ACROSS STATE LINES

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Introduction: Handguns are the most commonly used weapon in gun assaults in the US. States that have stronger laws restricting access to handguns—particularly by requiring purchasers to undergo a background check—have fewer gun assaults. However, sales between private buyers and sellers are exempt from background check requirements according to federal and most state laws, meaning that gun shows (i.e., conventions where private buyers and sellers trade firearms) are a potential pathway to accessing a handgun for people who would otherwise fail a background check. The aim of this study was to determine whether gun shows concentrate in counties proximate to states with weaker background check laws.

Methods: This cross-sectional study used gun show data from a public online listing for 2018 (*Gun Shows USA*) aggregated within 3106 counties in the contiguous 48 states. The main independent variable of interest was background check laws in interstate counties, calculated using a population-weighted distance decay function. We controlled for potential drivers of demand for gun shows, including within-state gun laws, interstate gun laws, local and in-flowing population size, and the proportion of the local and in-flowing population who were gun owners. Bayesian conditional autoregressive Poisson models estimated associations between interstate background check laws and the count of gun shows in each county while accounting for spatial dependencies and nesting of counties within states.

Results: There was a total of 1869 gun shows in the contiguous US in 2018, and a total of 20 states had any background check law during that year. Additional interstate background check laws were associated with a greater number of gun shows (IRR: 1.105, 95% CI: 1.033, 1.183).

Conclusion: Gun shows concentrate in US counties that are near to states with stronger background check laws. Gun shows may service demand for handguns among people living interstate who are excluded from handgun purchases due to background check laws.

Poster #84

IMPLEMENTATION OF A SELECTIVE SPINAL IMMOBILIZATION PROTOCOL DOES NOT ALTER PRACTICE PATTERNS IN A REGIONAL TRAUMA SYSTEM

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Introduction: Universal spinal immobilization has been the standard of prehospital trauma care since the 1960s. More recently, selective immobilization has been shown to be safe and effective for Emergency Medical Services (EMS) use, but it is unclear whether such protocols reduce unnecessary and potentially harmful spinal immobilization practices. This study evaluated the impact of a selective spinal immobilization protocol on practice patterns in a regional trauma system.

Methods: All encounters for traumatic injury in the Tidewater EMS Region from 2010 to 2016 were extracted from the Virginia Prehospital Information Bridge. An interrupted time series analysis was used to assess changes in spinal immobilization practices after systemwide protocol implementation in 2013. Intravenous (IV) access was used as a non-equivalent outcome measure in the absence of an appropriate control group.

Results: A total of 63,981 encounters were analyzed. At baseline, 29.5% of patients were immobilized. The pre-protocol slope was slightly positive (0.1% per month, $P<0.001$). Protocol implementation did not result in a significant level change in immobilization rates (35.5% to 35.2%, $P=0.686$). Post-protocol slope change was not significantly different from that observed for IV access (-0.5% vs -0.6% per month, $P=0.529$). Rates of immobilization for isolated penetrating trauma remained unchanged. Urban areas experienced larger slope and level changes after implementation.

Conclusion: A selective spinal immobilization protocol did not reduce prehospital immobilization rates in a regional trauma system. Given the entrenched nature of immobilization practices, more intensive de-implementation strategies are needed. Efforts should prioritize eliminating immobilization for isolated penetrating trauma given its association with increased mortality. Additional training resources should be dedicated to rural areas.

Poster #85

POOLED ANALYSIS OF LEVEL I TRAUMA CENTERS BETTER PREDICTS RISK FACTORS FOR GUN VIOLENCE RECIDIVISM

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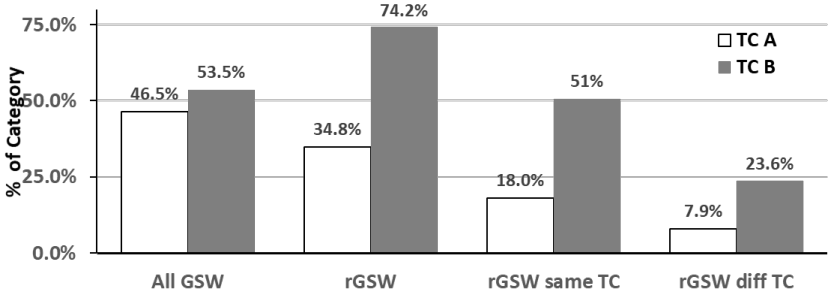
Introduction: Gun violence (GV) is a major public health challenge in the USA. Many trauma centers (TC) use the first GV admit as a teachable moment to mitigate repeat GV (rGV). Understanding rGV is especially difficult in metro areas with multiple TC and laws that prohibit sharing of private health information (PHI). We hypothesized that risk factors for rGV could be better understood using *pooled* data from metro TC.

Methods: Two metro TC registries were queried to identify all GV admits between 2007-17. A pseudo encryption tool allowed sharing of de-identified GV and rGV data without disclosing PHI. Factors associated with rGV admit including, age, sex, race, payor, injury severity, intent, and discharge, were assessed by multivariable logistic regression.



Results: We identified 2244 metro GV patients, 89 (4.0% total) of whom had subsequent rGV admit. Most rGV patients were assaulted (91%), male (97.8%), and black (86.5%). Time to rGV admit ranged from 0.6-12.2 yrs.
The **figure** shows major differences in rGV admit at two metro TC. It was noteworthy that 31.5% of rGV pts were admitted to a different TC. Independent predictors of rGV admit were age (aOR 0.94, P<0.001), male gender (aOR 6.18, P=0.013), Black race (aOR 5.14, P=0.007), or discharge against medical advice (aOR 6.64, P<0.001). Over the 10 yr study period GV admits increased 23.0%, but rGV admits went up 51.7%.

Conclusions: Nearly a third of rGV admits would have been missed in the current study without pooled metro TC data. The incidence of rGV is increasing and so it's important to target those at highest risk of repeat injury for mitigating interventions.

Poster #86

PREHOSPITAL ADVANCED AIRWAY MANAGEMENT FOR TRAUMATIC OUT OF HOSPITAL CARDIAC ARREST PATIENTS

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Background: Traumatic out of hospital cardiac arrest (OHCA) is severe condition. It is expected that advanced airway management (AAM), including endotracheal intubation and supraglottic device, would contribute the favorable outcomes among these patients. However, the benefit of prehospital AAM among traumatic OHCA is not established well. This study aimed to detect the efficacy of prehospital AAM among traumatic OHCA patients.

Methods: We conducted retrospective observational study with using Japanese nation-wide trauma database between 2004-2017. Among trauma patients received cardiac pulmonary resuscitation transferred from trauma scene, excluded age<15 or unknown, burn, missing prognosis, transportation time > 60 minutes or negative, transportation by helicopter medicine, and cardiac arrest at scene, 3,430 patients enrolled in this study. Patients were divided into two groups; those with AAM (N=3,052) during transportation and those without AAM (N=378). We compared two groups with propensity score matching. Primary outcome is in-hospital survival rate and secondary outcome is the rate of return of spontaneous circulation (ROSC) on admission.

Results: After propensity score matched, 644 patients were enrolled (AAM: 322 vs non AAM: 322). Adjusted logistic regression analysis did not show the significant difference between two groups on ROSC (AAM, 20.8%; non AAM 18.9%, p=0.70) and survival rate (AAM 5.3%; non AAM 8.4%, p=0.12). With multiple logistic regression analysis adjusted with ISS>15, head AIS (Abbreviated injury score)>=3, transfusion within 24 hours, and emergent surgical intervention, AAM did not show the significant difference on in-hospital survival rate (Odds ratio 0.61, 95%CI 0.32-1.17, p=0.14)

Conclusions: Prehospital AAM among traumatic OHCA patients did not have potential to improve patients' in-hospital prognosis.

Poster #87

THE ASSOCIATION BETWEEN GUN SHOWS AND FIREARM INJURIES: AN ANALYSIS OF 259 SHOWS ACROSS 23 CITIES

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Introduction: Guns shows are estimated to account for 4-9% of firearm sales in the US and are the location for both private party sales and sales by licensed firearm sellers. Increased regulation of firearm sales at gun shows has been proposed as one approach to preventing firearm injury. This study evaluates the association between gun shows and all-cause firearm injury in the communities where they are held.

Methods: We sought to determine whether there was an increase in rates of firearm injuries during the two weeks following a gun show compared to the two weeks prior within the community where the gun show was held. The *Big Show Journal* was used to determine the dates and locations of gun shows during 2017-2019. We selected a geographically representative convenience sample of US cities where gun shows were held. The primary outcome measure was the rate of all-cause firearm injury hospitalizations in counties within a 25-mile radius of the gun show, which was determined using data derived from trauma centers participating in NTDB whose catchment area included the relevant counties. Poisson regression modeling included a fixed effect for exposure period and was adjusted for seasonality, as well as random effects for both facility and gun-show clustering.

Results: A total of 259 gun shows from 23 cities were selected. Firearm injury data was collected from 36 trauma centers. In total there were 1,662 hospitalizations for firearm injuries pre-show and 1,665 post-show. The unadjusted mean rate of all-cause firearm injury per 1,000,000 population the 2 weeks before 1.76 (1.14-2.72) and 2 weeks after a gun show 1.79 (1.16-2.76) were comparable, p=0.68.

Conclusion: Rates of hospitalization for all-cause firearm injury were not significantly increased after a gun show in the communities where they are held. While there is not an immediate local effect, it is plausible that a longer time horizon and areas outside of the radius could be affected by these events. More detailed analyses of gun show firearm sales are needed to determine their impact on firearm injury rates more specifically.

Poster #88

THE NATIONAL TRAUMA TRIAGE PROTOCOL: HOW EMS PERSPECTIVE CAN INFORM THE GUIDELINE REVISION

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Introduction: The Field Triage Guidelines (FTG) support EMS-decisions regarding the most appropriate transport destination for injured patients. While the components of the algorithm are largely evidenced-based, the step wise approach was developed with limited input from EMS providers. FTG are only useful if they can easily be applied by the practitioner in the field. We sought to gather end-user input on the current guidelines from a broad group of EMS stakeholders to inform the next revision of the FTG.

Methods: An expert panel composed an end-user feedback tool. Data collected included: demographics, EMS agency type, geographic area of respondents, use of the current FTG, perceived utility and importance of each step in the algorithm (1: physiologic, 2: anatomic, 3 mechanistic, 4: special populations). The ACS COT, in partnership with several key organizations, distributed the tool to reach as many providers as possible.

Results: 3,958 people responded to the survey (82% Paramedics/EMTs, 9% physicians, 9% other). 94% responded directly to scene emergency calls and 4% were aeromedical. Steps 2 and 3 were used in 95% of local protocols, Step 1 and 4 in 90%. Step 3 was used equally in protocols across all demographics; however, Step 1 was used significantly more in the air medical services than ground EMS (96% vs. 88%, $p<0.05$). Geographic variation was demonstrated in FTG use based on the distance to a trauma center (table), but Step 3 (not step 1) drove the majority of the decisions everywhere. This point was reinforced in the qualitative data with the comment, "I see the wreck before I see the patient."

Avg Time To Closest TC	Non-Trauma Center Transport	More Likely transported by Air	Step Driving Majority of Decisions
0-30 Minutes	2.69%	11%	3
31-60 Minutes	22.42%	53%	3
61+ Minutes	58.82%	69%	3

Conclusions: The FTG are widely used by EMS in the US. The stepwise approach is useful; however, mechanism (not physiologic criteria) drives most of the decisions and is often the first criteria evaluated. Revision of the FTG should consider the experience of the end-users.

Poster #89

THE PREDICTIVE VALUE OF SHOCK INDEX IN RURAL TRAUMA TRIAGE, MORBIDITY AND MORTALITY

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Introduction: Rural trauma centers often have a dilemma as geography and transportation can pose significant delays to transfer to a tertiary referral center. The initial triage of the trauma patient that occurs in the prehospital and non-tertiary hospital setting is crucial in identifying which patients need expedited transfer to definitive care. Shock index (SI) or (Systolic Blood Pressure/Heart Rate) has been shown in the literature to predict increased risk of mortality and massive transfusion in trauma patients.
No previous studies have evaluated SI levels and looked at patients transferred from smaller centers to definitive care.

Methods: This was a retrospective study of trauma registry data at a rural level 1 trauma center. Shock index was calculated for 1,293 patients. The patient ages ranged from 18 years to 100 years old. Patients were assigned groups according to their shock index numbers (≤ .7, .71-.89, and ≥ .9). The SI was calculated both at the outside hospital and at arrival of our trauma bay. Pearson's correlation was used analyze hospital length of stay, intensive care unit days, ventilation days, and injury severity score with the respective SI scores. Analysis of variance was conducted for hospital stay, intensive care unit days, ventilation days, and injury severity score and blood product usage. Logistic regression was used to evaluate shock index and its relationship to mortality and use of blood products. Finally, chi square was used to determine the significance of patient disposition within the different index groups.

Results: There was no correlation in the field SI transfer group for ranges ≤ .7 and .71-.89 shock index. There were significant weak positive correlations in the prehospital transfers group for ISS, packed red blood cells, plasma, other blood products, and total blood products used in the ≥ .9 group ($p = < 0.05$).
In the Emergency Department (ED) arrival SI of the transfer group, there was no correlation for patients with a normal shock index of ≤ .7. Patients with an SI of .71-.89 showed significant positive correlation for ISS, plasma, platelets, and total blood products ($p =< 0.05$). Patients with a SI of ≥ .9 showed significant positive correlation for ISS, packed red blood cells, plasma, platelets, other blood substitute, and total blood products used ($p = < .05$).
The ED arrival SI of the transfer patients except those with an SI of >.9 demonstrated a statistically significant ($p=0.016$) trend towards increased mortality.

Conclusions: Rural trauma surgery can be complicated by long transfer times, geography, mode of transportation and weather. There has been no widely accepted method of decerning which patients require the most urgent attention. This study demonstrates patients in outside ED with elevated SI have need for more blood products and higher mortality. Outside ED SI should be considered an indicator or need for emergent transfer. SI can be easily taught to rural health care providers and provide a method of selecting which patients require rapid air transport to a definitive tertiary trauma center.

Poster #90

THE ROLE OF GEOGRAPHIC DISPARITIES IN OUTCOMES AFTER ORTHOPAEDIC TRAUMA SURGERY

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Introduction: Healthcare disparities on the basis of patient rurality and socioeconomic status are known to exist, but few studies have examined the effect of urban versus rural status on outcomes after orthopaedic trauma surgery. The aim of this study was to examine the correlation between patient rurality, socioeconomic status, and outcomes after orthopaedic surgery.

Methods: This is a retrospective cohort study of patients diagnosed with a hip or long bone fracture between January 2016 and December 2017. Data were collected from the Nationwide Inpatient Sample, a 20% weighted sample of 95% of the U.S. inpatient population. An ICD 10 diagnosis of hip fracture or long bone fracture was used to identify eligible patients. Patients were stratified into 3 groups: hip fracture, long bone fracture, and polytrauma. Analysis was conducted using population-weighted multivariable logistic regression models, based on a conceptual model derived selection of covariates.

Results: We included 244,344 patients diagnosed with a hip or extremity fracture. These were weighted to represent 1,221,720 patients nationally. In the hip fracture group, rural patient status was associated with higher odds of mortality (OR 1.32, $P<0.001$). In the extremity fracture and polytrauma groups, rural patient status was not associated with significantly higher odds of mortality or complications. In the urban polytrauma group, zip code with below-median income was associated with increased odds of mortality (OR 1.20, $P <0.001$). In the rural polytrauma group, zip code with below-median income was not associated with significantly increased odds of mortality.

Conclusion: We found that rural patients with hip fracture have higher mortality compared to urban patients and that socioeconomic disparities in mortality after a polytrauma exist in urban settings but not rural settings. The former may reflect lower volume of hip fractures seen in rural environments, delays to surgery among the rural group, or decreased access to geriatric co-management in rural hospitals. The latter may reflect health care segregation, wherein low-income patients have lower access to high-quality care.

Poster #91

DELAYED ENDOVASCULAR REPAIR WITH PROCEDURAL ANTICOAGULATION: A SAFE AND EFFECTIVE MANAGEMENT STRATEGY FOR BLUNT AORTIC INJURY

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University of Tennessee Health Science Center

Introduction: Blunt aortic (BAI) and traumatic brain injury (TBI) remain the two leading causes of death after blunt trauma. The purpose of this study was to identify predictors of mortality in patients with BAI and to examine the impact of systemic heparinization during thoracic endovascular aortic repair (TEVAR) on neurologic outcomes in patients with BAI and TBI.

Methods: Patients with BAI over a 7-year period were identified. Age, gender, severity of injury and shock, time to TEVAR, morbidity and mortality were recorded and compared. Multivariable logistic regression (MLR) analysis was performed to determine independent predictors of mortality. Youden's index was used to determine optimal time to TEVAR.

Results: 129 patients were identified. The majority (74%) were male with a median age and ISS of 40 and 29, respectively. Of these, 26 (23%) also had a concomitant TBI: 15 (57.7%) with severe TBI (GCS 3-8). Patients with BAI and TBI had a higher injury burden at presentation (ISS 37 vs. 29, p=0.002; GCS 6 vs 15, p<0.0001), underwent fewer TEVAR procedures (31% vs. 53%, p=0.039) and suffered increased mortality (39% vs. 16%, p=0.009) compared to BAI patients without TBI. All patients undergoing TEVAR received systemic heparinization regardless of associated injuries, including TBI. In TBI patients undergoing TEVAR, there was no change in CTH post-TEVAR and mean GCS at discharge was unchanged from admission (12 vs 12, p=0.530). The optimal time to TEVAR for all patients was determined to be 15 hours. Mortality was increased in patients undergoing TEVAR prior to 15 hours (8.7% vs 0%, p=0.210). MLR identified lower admission GCS (OR 1.24; 95%CI 1.12-1.38, p<0.0001) and increasing grade of BAI (OR 1.87; 95%CI 1.03-3.41, p=0.040) as independent predictors of increased mortality and use of TEVAR as the only modifiable risk factor significantly associated with reduced mortality (OR 0.11; 95%CI 0.03-0.45, p=0.002) in all patients with BAI.

Conclusions: For BAI patients, higher grade of aortic injury and lower GCS increased mortality. TEVAR use was identified as the only *modifiable* predictor of reduced mortality in patients with BAI. Delayed TEVAR with use of procedural heparin provides a safe option regardless of TBI with improved survival and no difference in discharge neurologic function.

Poster #92

INTRODUCING FIXED-VOLUME AORTIC OCCLUSION FOR FLUOROSCOPY-FREE REBOA

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Objectives: To investigate a new concept of Fixed-Volume Aortic Occlusion (FVAO) in fluoroscopy-free REBOA, a novel 4 French REBOA device, the COBRA-OS, with its unique safety shoulder reservoir, was intentionally over-inflated in porcine models to determine the safety and feasibility of FVAO. Adding to the previously described "fixed-distance" model, FVAO aims to simplify REBOA by enabling safe inflation to a set volume instead of relying on blood pressure to guide aortic occlusion.

Methods: COBRA-OS devices were incrementally inflated in segments of cadaveric swine thoracic aorta until either rupture of the balloon or the aorta occurred. Devices were then deployed in the thoracic aorta of anesthetized swine with an intentionally exaggerated fixed volume of 20mL representing a compliant balloon diameter of 28mm (normal max volume 13mL/25mm).

Results: Six cadaveric swine thoracic aorta segments were tested with a mean baseline aortic diameter of 21±0.098mm. The mean inflation volume for aortic occlusion was 5.85±0.42mL and for balloon rupture was 86.3±6.77mL. No aortic rupture or intimal tissue damage occurred despite >1000% increase in inflation volume above the aortic occlusion volume. The mean circumferential stretch ratio at the intentionally exaggerated fixed volume of 20mL was 1.3±0.12 and at balloon rupture was 1.53±0.04. No circumferential stretch ratio ever reached the known aortic failure threshold of 1.8. The amount of balloon longitudinal deformation at the fixed volume of 20mL was 48±7.5mm and at balloon rupture was 127±1.4mm. Subsequently, 3 adult female swine were tested with a mean Zone 1 thoracic aortic occlusion diameter of 15±0.15 mm. The mean inflation volume for aortic occlusion was 7±2mL and at 20mL fixed inflation volume (186% increase), there were no ruptures of the aorta or balloon and no evidence of intimal tissue damage.

Conclusions: Our study is the first to introduce the concept of FVAO in order to simplify and improve the safety of REBOA procedures. Activation of the unique safety shoulder reservoir of the COBRA-OS allows for significant over-inflation without the risk of balloon or aortic rupture and has acceptable longitudinal deformation values. Further studies to confirm these findings in humans and to determine the ideal fixed volume for aortic occlusion are needed.

Poster #93

THE EARLY USE OF LYOPHILIZED CRYOPRECIPITATE AMELIORATES THE ENDOTHELIOPATHY OF TRAUMA FOLLOWING HEMORRHAGIC SHOCK

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Introduction: Recent studies in severely injured patients suggest an important role of von-Willebrand Factor (VWF) in the endotheliopathy of trauma (EoT). We *hypothesized* that the early use of cryoprecipitate would be effective as an endothelial protector to reverse the EOT by regulating VWF reactivity. We utilized a pathogen-reduced lyophilized cryoprecipitate (LC) that could expedite the early administration of cryoprecipitate to patients in hemorrhagic shock (HS).

Methods: A mouse liver transection model of uncontrolled hemorrhage (UCH, 60 minutes shock) was utilized followed by hypotensive resuscitation (MAP 55-60) x 3 hours with Lactated Ringers (LR), fresh frozen plasma (FFP), or LC to mimic prolonged transport. Blood was collected for syndecan (Sdc), VWF Antigen (Ag), VWF collagen binding (CB), and ADAMTS13 by ELISA. Analysis by ANOVA followed by Bonferroni, n=8-10/group.

Results: Following UCH, blood loss was similar across groups. Mean volume of resuscitation was 1,288ml LR, 294ml FFP, 285ml LC, $p<0.001$. Sdc levels were higher with LR compared to sham, FFP, and LC. VWF:Ag:ADAMTS13 ratio as well as VWF:CB:ADAMTS13 ratio were lower in the FFP and LC groups compared to LR and shams, $p<0.001$. [Table 1]

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Conclusion: Lyophilized cryoprecipitate was as effective as FFP in ameliorating the EoT and reducing pathologic hyperadhesive VWF. These results combined with the known hemostatic effects of cryoprecipitate support the early use LC for patients in HS.

Table 1	Sham	LR	FFP	LC	*p*
Sdc	8.6±3.4	17.4±4	8.7±3.6	9.3±3.6	<0.001
VWF Ag:ADAMTS13	2±0.4	1.5±0.4	0.8±0.2	0.6±0.1	<0.001
VWF CB:ADAMTS13	0.5±0.5	0.8±0.3	0.2±0.1	0.3±0.1	<0.001

Poster #94

OPERATIVE TRAUMA VOLUME IS NOT RELATED TO RISK-ADJUSTED MORTALITY RATES AMONG PENNSYLVANIA TRAUMA CENTERS

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Introduction: Higher center-level operative volume is associated with lower mortality after complex elective surgeries, but this relationship has not been robustly demonstrated for operative trauma. We hypothesized that trauma centers in Pennsylvania with higher operative trauma volumes would have lower risk-adjusted mortality rates than lower volume institutions.

Methods: We queried the Pennsylvania Trauma Outcomes Registry (2017-2018) for injured patients ≥18 years at Level I&II trauma centers who underwent an ICD-10p defined operative procedure within 6 hours of admission. The primary exposure was tertile of center-level operative volume. The primary outcome of interest was inpatient mortality. We entered factors associated with mortality in univariate analysis (age, injury severity, mechanism, physiology) into multivariable logistic regression models with tertiles of volume accounting for center-level clustering. We conducted secondary analyses varying the form of the association between the volume and mortality to including dichotomous and fractional polynomial models.

Results: We identified 2,477 patients at 30 centers meeting inclusion criteria. Overall mortality was 16.3% (center-level range 5.5-28.2%). Operative procedure types were cardiopulmonary (7.6%), vascular (20.4%), abdominopelvic (24.2%), and multiple (47.8%). The median annual operative volume was 29 (IQR 23-24) for low volume centers, medium 55 (IQR 51.5-72.5), and high 110 (IQR 102.5-196). After controlling for patient demographics, physiology, and injury characteristics, there was no significant difference in mortality between highest and lowest tertile centers (OR 0.98, CI 0.59-1.63). Further secondary analyses similarly demonstrated no relationship between center operative volume and mortality.

Conclusion: In a mature trauma system, we found no association between center-level operative volume and mortality for patients that required operative intervention for trauma. Efforts to standardize the care of seriously injured patients in Pennsylvania may ensure that even lower volume centers are prepared to generate satisfactory outcomes.

Poster #95

OPTIMIZING ACCESS TO TRAUMA CENTER CARE IN A RURAL STATE WITH A TRAUMA SYSTEM: A GEOGRAPHIC LOCATION ALLOCATION ANALYSIS

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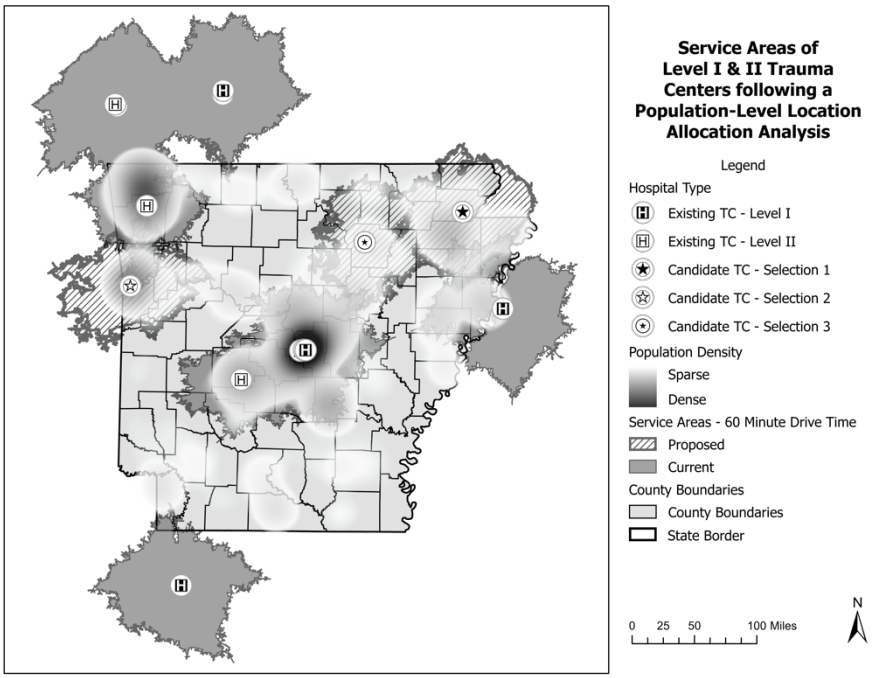
Introduction: Timely (<60 minutes) access to higher level (I/II) trauma center (HLTC) care improves survival and functional outcomes. However, trauma center locations are often driven by factors other than the needs of the population. Additionally, there is a paucity of state/regional level studies identifying optimal HLTC locations that will maximize population coverage. This study analyzes HLTC access in a rural state and utilizes geographic information system (GIS) methods to identify existing hospital targets for upgrade to Level-II, maximizing population access and strengthening the state trauma system.

Methods: Data for all hospitals within the state trauma system- locations, bed capacity, and designation - were collected. Population density, road network layout, and 60-minute EMS ground transport interval were used to construct a location-allocation model and identify the best-fit facilities for upgrade. Adult facilities with any lower-level TC designation, more than fifty beds, and more than fifty miles from an existing HLTC were considered for upgrade.

Results: Location-allocation modeling identified three facilities as potential candidates for upgrade to Level II (Fig.). This increase in system capacity would reduce the proportion of the state population without access to HLTC care within 60 minutes from 43% to 26%.

Conclusions: The study demonstrates the utility of geospatial mapping and location-allocation modeling, to identify gaps in areal access to HLTC care and determine optimal trauma center locations to maximize population coverage. This methodology has potential to objectively identify facilities for targeted capacity improvement and system design which emphasizes more equitable access to trauma center care in any state/region.



Poster #96

THROMBIN GENERATION IN ACUTE TRAUMATIC COAGULOPATHY: FRIEND OR FOE?

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Background: Uncontrolled bleeding associated with acute traumatic coagulopathy remains the most common avoidable cause of death in the multiple injured patient. The pathophysiology of this phenomenon has been widely investigated but is still poorly understood. In this study we focused on thrombin generation as a response to induced severe trauma and haemorhage in a pre-clinical animal model. The role of procoagulant therapy was addressed to clarify both its impact in thrombin generation as well as its relevance in the treatment of trauma-associated coagulopathy.

Method: Four groups of 15 Wistar rats were compared: vehicle (V), Factor II 16 mg (FII 16 mg); Factor II 2 mg (FII 2mg) and Prothrombin Complex Concentrate (PCC). Blood samples were drawn at baseline and after an established shock period of 60 minutes, roughly 105 minutes from initial trauma. Shock severity and coagulopathy was characterized in all surviving animals. Thrombin generation was assessed via calibrated automated thrombogram (CAT) method.

Results: Shock was successfully achieved in all studied animals (mean blood pressure of 30 ± 5 mmHg kept for a period of 60 minutes, and lactate greater than -15mmol/l in all animals. Coagulopathy was established via both viscoelastic and standard coagulation tests. Endogenous thrombin potencial was significantly increased in the group supplemented with 16 mg of factor II (ETP FII16 T60 vs FII16 T0: 1059 □ 164 mM.min vs 334.6 □ 59.3mM.min, $p < 0,0002$; ETP PCC T60 vs PCC T0: 939.3 □ 164 mM.min vs 279 □ 30 mM.min, $p < 0,0001$). In the vehicle group it remained unchanged, and in the group supplemented with a lower dose of factor II there was an increasing trend although notstatistically different.

Conclusions: Thrombin generation seems to be preserved if not enhanced as result of trauma and haemorrhage insult. The use of procoagulant drugs, not only do not present any advantage in treatment of trauma patients as pose increased hazard regarding thromboembolic events. Hence its use should be discretionary in a case-by-case basis.

Poster #97

TWENTY YEARS OF PROGRESS IN PENNSYLVANIA TRAUMA OUTCOMES

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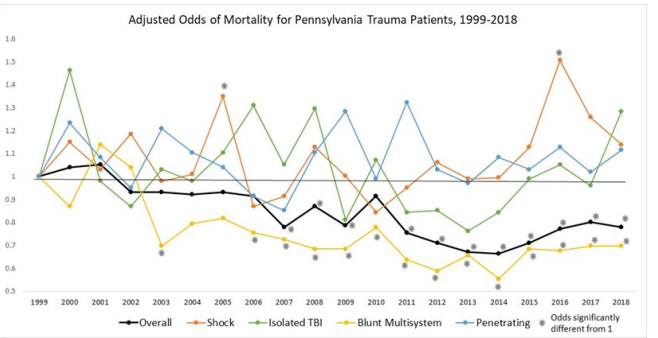
Introduction: Trauma center mortality rates are benchmarked to expected rates of death based on patient and injury characteristics. The expected mortality rate is recalculated from pooled outcomes across a trauma system each year, obscuring system-level change. We hypothesized that risk-adjusted mortality would decrease over time system-wide.

Methods: We identified adult trauma patients presenting to Level I and II Pennsylvania trauma centers, 1999-2018, using the Pennsylvania Trauma Outcomes Study. Multivariable logistic regression generated risk-adjusted models for mortality in all patients, and in key subgroups: penetrating torso injury, blunt multi-system trauma, isolated traumatic brain injury (TBI), and patients in shock.

Results: Of 172,878 included patients, 131,026 (75.8%) were white and 114,922 (66.5%) were male. The mean age was 49, mean injury severity score was 16.7, and 87.5% of injuries were blunt. Overall, 10.6% of patients died, and compared to 1999, no year had significantly higher adjusted odds of mortality. Overall mortality was significantly lower in 2007-2009 and 2011-2018. Of patients with blunt, multi-system injuries, 18.5% died, and adjusted mortality improved over time. Mortality rates were 43.0% for TBI, 26.3% for penetrating torso injury, and 58.0% for shock, with no significant change in these categories (Figure).



Conclusions: Over 20 years, Pennsylvania trauma centers demonstrated improved risk-adjusted mortality rates overall, but improvement was uneven across clinical categories. Identifying change over time can help guide focus to areas in need of improvement.

Poster #98

UNIQUE ROLES OF CALCIUM-INDEPENDENT PHOSPHOLIPASE A_2 IN HUMAN PLATELET FUNCTION

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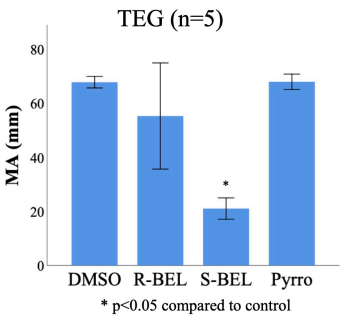
Introduction: Platelet activation plays a key role in the development of sepsis-induced coagulopathy and multiple organ dysfunction. Recent studies have reported that calcium-independent phospholipase A_2 ($iPLA_2$) enzyme in cells such as neutrophils, vascular endothelial cells, and macrophages, is associated with acute inflammation, but its function in platelets remains obscure. Our objective was to evaluate the function of $iPLA_2$ in platelets.

Methods: Blood collected from healthy volunteers was analyzed. Platelet aggregometer (PA) and thromboelastography (TEG) were used for the platelet aggregation study. For the PA analysis, thrombin (0.2 IU/ml) was used as an agonist, and for the TEG analysis, kaolin was used. Furthermore, serotonin and thromboxane B_2 (TXB2) concentrations of the thrombin-stimulated platelets were measured using enzyme-linked immunosorbent assay. For all the studies, the samples were preincubated with the following inhibitors: pyrrophenone (Pyrro) for cytosolic PLA_2 ($cPLA_2$), (S)-bromoenol lactone (S-BEL) for $iPLA_2\beta$, (R)-bromoenol lactone (R-BEL) for $iPLA_2\gamma$, and dimethyl sulfoxide (DMSO) for control.

Results: Platelet aggregation (n=6) was inhibited significantly with S-BEL (S-BEL: 16.0 ± 3.6%; R-BEL: 35.3 ± 7.2%; Pyrro: 87.5 ± 2.0%). Maximum amplitude (MA) in TEG also decreased significantly with S-BEL (S-BEL: 21.0 ± 3.8 mm; R-BEL: 55.2 ± 9.8 mm; Pyrro: 67.9 ± 1.4 mm). Pyrro failed to show any inhibition in both PA and TEG. Serotonin concentration (n=8) was also suppressed by S-BEL (S-BEL: 38.8 ± 12.2 ng/ml; R-BEL: 53.2 ± 24.4 ng/ml; Pyrro: 71.6 ± 35.8 ng/ml). However, these results did not correlate with TXB2 concentration (n=8) as Pyrro significantly inhibited the TXB2 synthesis (S-BEL: 31.2 ± 8.5 ng/ml; R-BEL: 43.0 ±14.6 ng/ml; Pyrro: 9.9 ±4.0 ng/ml).



Conclusion: $iPLA_2\beta$ is strongly associated in thrombin-stimulated aggregation and degranulation, and could possibly be playing a major role in human platelet function.

Poster #99

XSTAT® STOPS BLEEDING AND MAINTAINS HEMOSTASIS 72-HOURS POST-HEMORRHAGE ADMINISTRATION

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Background: Implementation of hemostatic interventions such as tourniquets reduced extremity hemorrhage mortality in US military personnel, however, of the casualties that die, 50% succumb to non-compressible truncal hemorrhage and 20% die due to junctional hemorrhage. XSTAT® was developed to address junctional/non-compressible hemorrhage (J/NCH). It is FDA approved for up to four hours and is currently fielded by the US SOCOM to treat J/NCH. Top priority for military medical capabilities is to expand beyond the 'Golden Hour' of care for austere environments requiring prolonged field care (PFC) with evacuation times to definitive care measured in days as opposed to hours. To bridge this gap, we propose to evaluate the efficacy of XSTAT® administration for 72-hours in a 61-96 kg male Yorkshire swine model of uncontrolled subclavian artery (SCA) and vein (SCV) hemorrhage.

Methods: The left SCA/SCV were isolated by blunt dissection and injured by a 50% transection, followed by 30-seconds of free hemorrhage. Immediately following free hemorrhage, XSTAT®s were administered per manufacturer's instructions until bleeding stopped and remained within subjects for 48-hours (n=4) and 72-hours (n=1) and covered with four 4x4 inch 8-ply cotton gauze secured with Tegaderm™. Gauze was evaluated hourly for indications of sanguineous or hemorrhagic drainage and was changed at 75% saturation. Results were analyzed with two-tailed unpaired t-test, and data is represented as mean±SD with significance as alpha<0.05.

Results: No significant differences observed in 30-second hemorrhage volume, XSTAT® absorbed blood volume and total shed blood volume between 48-hour and 72-hour cohorts (508.3±172.87mL) vs. (863.92mL), (433.97±188.57mL) vs. (278.85mL), and (943.31±110.67mL) vs. (1,142.77mL) respectively. All animals displayed benign serosanguineous drainage manifested without indications of sanguineous, hemorrhagic or purulent drainage throughout the simulated PFC event.

Conclusions: Early indications suggest XSTAT®'s utility for J/NCH control for PFC casualties, but the authors caution that further rigorous investigation with larger cohort populations are warranted to determine the efficacy and safety of the XSTAT® device for deployment in the PFC setting.

Poster #100

TREATMENT EFFECT OF HELICOPTER TRAUMA TRANSPORT: A NATIONAL PROPENSITY SCORE MATCHED ANALYSIS

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Introduction: With a lack of randomized controlled trials and substantial selection bias inherent in observational studies, the benefits of helicopter over ground transport remain uncertain. This study utilizes propensity score matching to quantify the treatment effect of helicopter transport.

Methods: All injured patients transported by emergency medical services from scene within 6-hours in 2017 National Trauma Data Bank were included. Propensity score matched analyses, with Mahalanobis nearest neighbor matching, were used to mitigate selection bias and compare subgroups. Patients were matched on demographics, comorbidities, mechanism, injury severity score (ISS), anatomic injury scales, physiology (respiratory, circulatory, neurologic), transport time, and trauma center (TC) level.

Results: 408,563 patients were included [Helicopter: 31,650 (7.75%); Ground 376,913 (92.76%)]. Helicopter patients were younger, male preponderant, more injured, physiologically deranged and suffered higher mortality (8.74% vs. 5.09%). After propensity score matching, helicopter transport demonstrated a 1.08% (95% CI 1.43-0.72, $p < 0.001$) reduction in mortality. In subgroup analysis, mortality benefit was observed for younger patients (5-64 years), more injured (ISS > 15), in shock (SBP < 90), with low GCS (< 14), and in respiratory distress (RR < 10 or > 29). Benefit of helicopter transport was highest at Level I TCs, followed by Level II and non-existent at Level-III (Figure). The greatest treatment effect was seen for patients in shock, mortality reduction of 11.24% (CI 15.12-7.37, $p < 0.001$).

Conclusions: After propensity matching, helicopter transport for trauma resulted in 1.08% reduction in mortality. The benefit was greatest for patients that were young, more injured, in shock or respiratory distress, and treated at the higher level TCs.

Treatment Effect of Helicopter Transport on Mortality (Overall and by Subgroups)

	ATE	95% CI	p-value	NNT
Overall	-0.0108	(-0.0143, -0.0072)	<0.001	92.9
Age ≥ 65	0.0054	(-0.0103, 0.0211)	0.498	-
Age 5-64	-0.0108	(-0.0173, -0.0043)	0.001	59.0
Age < 5	-0.0113	(-0.0239, 0.0014)	0.081	-
GCS ≤ 13	-0.0313	(-0.0606, -0.0020)	0.037	32.0
GCS > 13	0.0005	(-0.0024, 0.0034)	0.755	-
SBP < 90	-0.1124	(-0.1512, -0.0737)	<0.001	8.9
SBP ≥ 90	-0.0019	(-0.0054, 0.0016)	0.281	-
RR < 10 or > 29	-0.0919	(-0.1347, -0.0491)	<0.001	10.9
RR 10-29	-0.0058	(-0.0088, -0.0027)	<0.001	173.8
ISS > 24	-0.0801	(-0.1185, -0.0417)	<0.001	12.5
ISS 16 - 24	-0.0232	(-0.0329, -0.0134)	<0.001	43.2
ISS 9-14	-0.0033	(-0.0093, 0.0026)	0.277	-
ISS < 9	-0.0018	(-0.0048, 0.0011)	0.219	-
Level I TC	-0.0103	(-0.0159, -0.0047)	<0.001	96.8
Level II TC	-0.0084	(-0.0154, -0.0014)	0.019	119.3
Level III TC	0.0330	(-0.0385, 0.1044)	0.366	-

Abbreviations: ATE (Average Treatment Effect), CI (Confidence Interval), NNT (Number Needed to Treat), GCS (Glasgow Coma Scale), SBP (Systolic Blood Pressure), RR (Respiratory Rate), ISS (Injury Severity Score), TC (Trauma Center)

Poster #101

DEVELOPMENT OF A QUALITY ASSESSMENT/QUALITY IMPROVEMENT TOOL FOR BENCHMARKING PERFORMANCE IN AN URBAN TRAUMA CENTER

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Introduction: Current practice is to use externally validated survival prediction models to assess mortality. We take a different approach and use a locally generated prediction model that is internally validated to then assess that Trauma Service's performance over time.

Methods: Retrospective study design used an urban Level-II ACS Trauma Center trauma registry for a 4-year period (2016 to 2019). Patients were excluded if missing demographic or discharge data (N=502). Morality prediction was modeled using logistic regression (LR) and odds ratios (ORs) were calculated for significant variables ($p<0.05$). Discrimination (Area under the Receiver Operator Curve (AuROC)) and calibration (Hosmer-Lemeshow C-statistic (HL-C)) measured predictive capability.

Results: Final model included 3,068 patients, 2,287 (74.5%) in 2016-2018, and 781 (25.5%) in 2019, with AuROC of 0.95 and an HL-C of 3.68 ($p>0.05$). Predicted and observed mortality (95% CI) from 2016-2018 was 3.02% (2.59, 3.45) and 3.0% (2.31, 3.73), respectively. With the 2016-2018 model as a reference, 2019 predicted mortality (3.06%, 95% CI: 2.33, 3.78) did not differ significantly from observed mortality (2.4%, 95% CI: 1.34, 3.53), implying equal performance for the two time periods.

Conclusions: We generated and internally validated a LR model with excellent prediction of survival and used this to assess Trauma Service performance for the subsequent year. We will use this model on a continual basis to benchmark Trauma Service performance.

Table 1. Significant predictors and corresponding ORs. Groups were compared by Student's t test for continuous variables and χ^2 statistic for categorical values (* = $p<0.05$).

	2016-2018 (N = 2287)	2019 (N = 781)	Odds Ratio	95% C.I.for EXP(B) Lower	Upper
Age (Mean ± SD)	49.0 ± 22.9	49.3 ± 22.9	1.032	1.014	1.049
Insurance Type (%)					
Public*	1443 (63.1)	554 (70.9)	1	1	1
Private (Public)	581 (25.4)	179 (22.9)	0.555	0.238	1.296
Out of Pocket (Public)	48 (2.1)	10 (1.3)	8.733	2.444	31.209
Other (Public)*	215 (9.4)	38 (4.9)	0.902	0.259	3.135
Pulse Rate (Mean + SD)	90.1 ± 18.8	89.2 ± 18.4	1.017	1.003	1.032
GCS Motor (Mean + SD)	5.8 ± 0.8	5.9 ± 0.71	0.477	0.391	0.581
Base Deficit (Mean + SD)	0.58 ± 3.8	0.70 ± 4.5	0.907	0.852	0.964
Hematocrit (Mean + SD)	39.6 ± 5.3	39.6 ± 5.4	0.948	0.898	1
NISS (Mean + SD)	12.69 ± 11.4	13.4 ± 11.4	1.052	1.034	1.07
Comorbidities (%)					
Current Smoker*	540 (23.6)	148 (19.0)	0.229	0.063	0.836
Chronic Lung Pathology	331 (14.5)	123 (15.7)	0.199	0.048	0.83
Chronic Liver Pathology*	84 (3.7)	47 (6.0)	7.273	2.592	20.409
Chronic Drug Abuse	173 (7.6)	65 (8.3)	0.187	0.038	0.931
Chronic Kidney Pathology	71 (3.1)	33 (4.2)	3.047	1.052	8.829
Blood Thinners	127 (5.6)	32 (4.1)	7	3.058	16.02

Poster #102

EARLY REPAIR OF ISOLATED HIP FRACTURES FOR PATIENTS ON DIRECT ORAL ANTICOAGULANTS MAY BE SAFELY ACCOMPLISHED WITHOUT REVERSAL

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Introduction: Definitive surgery within 24 hours for patients with isolated hip fractures (IHF) may be associated with improved outcomes. Patients with IHF on direct oral anticoagulants (DOAC) may have their DOAC held for 24 hours before surgery or reversed preoperatively. The goal of this study is to compare the impact of varying approaches to DOAC management on IHF transfusion requirements and patient outcomes.

Methods: A 3-year multicenter retrospective analysis obtained from a hospital system's clinical data warehouse of patients on DOAC who had IHF surgery. Patients were grouped by surgery ≤24 and 24-72 hours. The primary outcome was the odds of receiving red blood cell transfusion (pRBCTx) during or after surgery. Results were analyzed by DOAC reversal status. Multivariable regression was done using risk adjusted analyses to account for age, gender, ISS, co-morbidity, and hospital practice variation.

Results: 1,806 patients on DOAC were selected, 60% had surgery ≤24 hours. Patients who had surgery at 24-72 hours were more likely to receive pRBCTx either during or after surgery, aOR 9.55 (95% CI: 3.20, 27.58). Patients treated with reversal agents were also more likely to receive pRBCTx with surgery at ≤24 and 24-72 hours, aOR 8.78 (95% CI: 1.13, 68.25) and aOR 3.56 (95% CI: 1.7, 7.44) respectively. For the <24 hour cohort, DOAC reversal was associated with significantly longer hospital length of stay (7.8 ± 7.4 days vs. 5.2 ± 3.2 days, $p<0.001$) and hospital charges ($221,784 ± $178,314 vs. $130,657 ± $68,329, $p<0.001$). Mortality rates were similar between DOAC reversal and no reversal at 1.4% vs. 1.3%, $p=0.94$ respectively.

Conclusion: Definitive IHF surgery for patients on DOAC may be performed ≤24 hours of admission generally without reversal. Reversal of DOAC is associated with higher likelihood of pRBCTx, longer LOS and higher hospital charges with no significant differences in inpatient mortality.

Poster #103

PATIENT AND PROVIDER PERCEPTIONS OF THE TRAUMA AND EMERGENCY GENERAL SURGERY DISCHARGE PROCESS

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Introduction: Trauma and Emergency General Surgery (TEGS) patients face complex barriers that hinder successful recovery after discharge. Improved understanding of the challenges in the hospital discharge process experienced by key stakeholders is necessary to develop interventions applicable to this complex, poorly standardized transition of care.

Methods: We performed a qualitative study of patient and provider perceptions about the hospital discharge process at an urban level 1 trauma center. We performed semi-structured interviews that we recorded, transcribed, coded inductively, and analyzed thematically.

Results: We interviewed 20 patients and providers (10 of each). Most patients (70%) were male, and the mean age was 57 ± 16 years. Providers included attendings, residents, nurse practitioners, registered nurses and case managers. Three key themes emerged. (1) Communication (patient-provider and provider-provider): Providers understood that discharges do not go smoothly when communication with patients is not clear. Many patients discussed confusion about their discharge plan. All lamented that poorly written discharge summaries are an inadequate means of communication between inpatient and outpatient providers. (2) Discharge teaching and written instructions: Patients recalled discharge teaching positively but found written discharge instructions to be overwhelming and unhelpful. Providers want to spend more time teaching patients and understood that written instructions contain too much jargon. (3) Outpatient care coordination: Patients and providers commented on difficulties with coordinating outpatient care. Both groups endorsed that a patient's primary care provider and insurance coverage are central components of the outpatient experience.

Conclusion: TEGS patients face several challenges at discharge. Providers struggle to effectively help their patients with this stressful transition. Future interventions should focus on improving communication with patients using deliberate, closed-loop techniques (e.g., teach-back method), repurposing and standardizing the discharge summary to serve primarily as a means of care coordination, insisting that written discharge instructions be truly patient-centered, and assisting the patient with navigating the transition.

Poster #104

THE DECLINING USE OF OPIOIDS AT A LEVEL 1 TRAUMA CENTER

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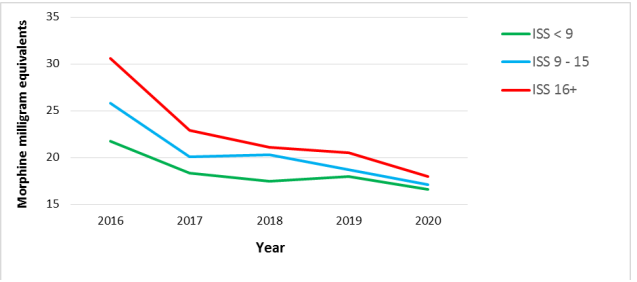
Background: The epidemic of opioid-related overdose in the U.S. prompted a public health response that included implementation of opioid-prescribing rules and restrictions. Such directives, however, were not applicable to trauma patients while hospitalized. We hypothesized that although prescribing mandates did not apply to hospitalized trauma patients, inpatient opioid administration had nonetheless decreased over time.

Methods: Opioid administrations for each patient admitted to a Level 1 trauma center between January 1, 2016 and July 31, 2020 were converted into oral morphine milligram equivalents (MME) and summed at the patient level to obtain a total amount of MME administered. MME was natural log transformed to achieve a normal distribution. General linear models were then used to determine the average patient MME administered by year. Patients who were pregnant or mechanically ventilated were excluded.

Results: 6594 patients were included in our analysis, of which 5037 (76.4%) were treated with opioids during their hospitalization. The percentage of patients administered an opioid decreased stepwise from 79.3% in 2016 to 71.4% in 2020 ($P<0.001$). For patients administered opioid, a 29% decrease in average total MME from 2016 to 2020 ($P<0.001$) was observed. With stratification by ISS (<9, 9-15, 16+), average total MME consistently trended downward (Figure).

Conclusion: Our trauma center realized a stepwise reduction in opioid administration in the absence of restrictions surrounding in-hospital opioid prescribing. Although patient satisfaction with pain management over this time is unknown, it appears that regardless of injury severity trauma patients can be managed with less opioids than have been used in the recent past.



Poster #105

ELECTRONIC HEALTH RECORD ARTIFICIAL INTELLIGENCE MODEL PREDICTS TRAUMA INPATIENT MORTALITY IN REAL-TIME

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Introduction: Patient outcome prediction models are underutilized in clinical practice due to lack of integration with real-time patient data. The electronic health record (EHR) has the ability to utilize artificial intelligence (AI) to develop predictive models. While an EHR AI model has been developed to predict clinical deterioration, it has yet to be validated for use in trauma. We hypothesized that the Epic Deterioration Index (EDI) would predict mortality and unplanned ICU admission in trauma patients.

Methods: This is a retrospective analysis of patients admitted to a level 1 trauma center from October 2019 to July 2020 for >24 hours, identified in the trauma registry. We evaluated the performance of EDI, obtained from the EHR, in predicting mortality and unplanned ICU admissions by examining the area under the receiver-operating-characteristic curve (AUC) and benchmarking it against existing predictors, including injury severity score (ISS). We performed a 5 to 1 match on age as it is a major component of EDI.

Results: The study cohort consisted of 1433 patients admitted with a mean age of 52.7 years and 90.7% following blunt injury. The in-hospital mortality rate was 1.9% and unplanned ICU admission rate was 2.8%. In predicting mortality, the max EDI within 24 hours of admission performed better than ISS in both matched and unmatched analysis (Table 1), with both predictors having an AUC > 0.90. An EDI of 80 had a 93% sensitivity, 94% specificity, and 23% positive predictive value (PPV) for mortality. For unplanned ICU admission, the prediction model for max EDI within 24 hours of ICU admission had a modest performance (Table 1); an EDI of 67.5, had a 26% sensitivity, 94% specificity, and 17% PPV.

Table 1 – Summary of Model Performances

Model	AUC	Age Matched AUC
Max EDI vs Mortality	0.981	0.981
ISS Probability vs Mortality	0.921	0.909
Max EDI vs unplanned ICU Admission	0.667	0.610

Conclusion: EDI appears to predict in-patient mortality similarly to ISS. This real-time EHR AI-based decision support tool can be used to predict in-patient mortality and unplanned ICU admission in trauma patients.

Poster #106

FACTORS ASSOCIATED WITH LIMITATION OF CARE AFTER FATAL INJURY

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Background: There is substantial variability in end-of-life (EoL) care practices in trauma patients. For those who survive initial resuscitation, most deaths occur in the intensive care unit after life-sustaining care is limited by patients or family. This study investigated predictors of limitation of care (LoC) for patients dying in a level I trauma center.

Methods: All adult trauma mortalities admitted between 1/1/16 - 6/30/20 were included. Patients were stratified into full code vs. any LoC (do not resuscitate, no escalation, withdrawal of care, or brain death). Patients who died in the emergency department were excluded given lack of time for EoL conversations. Data were further stratified based on time to LoC. Kruskal-Wallis test, Fisher exact test, and unadjusted logistic regression were used to compare groups. Results report n (%), median (interquartile range [IQR]), and odds ratios (OR) with 95% confidence intervals (CI). Alpha = 0.05

Results: 181 patients were reviewed. Age increased the odds of implementing LoC, whereas number of anatomic injuries and in-hospital complications decreased likelihood of LoC. 82% of patients had LoC initiated <14 days after admission. Those with late initiation of LoC had lower injury severity scores (ISS) and frequency of severe head injury (Head/Neck Abbreviated Injury Scale score >3).

Parameters	**Full Code** (n=16)	**Care Limited** (n=165)	**OR**	**95% CI**	**p-value**
Age (years)	66 (53, 76)	81 (71, 87)	1.05	1.02, 1.08	0.001
Gender (male)	12 (75)	86 (52)	0.36	0.11, 1.17	0.090
FHS Score (independent)	9 (56)	56 (45)	0.27	0.08, 1.06	0.061
ISS	22 (09, 35)	13 (09, 26)	0.97	0.94, 1.01	0.104
Number of Injuries (median/patient)	10 (02, 19)	4 (02, 08)	0.91	0.85, 0.97	0.004
Complications					
0	9 (56)	140 (85)	Reference		
1	4 (25)	14 (08)	0.22	0.06, 0.82	0.024
≥2	3 (19)	11 (07)	0.23	0.06, 0.99	0.049

Conclusion: Most LoC occurred within 14 days of admission. Patients with late LoC had less severe head injury and lower ISS. Number of injuries and in-hospital complications correlated with decreased odds of LoC, likely because they acted as proxies for overall patient acuity. Earlier consideration for LoC in patients with less severe injury may decrease ultimately futile hospital utilization.

Poster #107

FACTORS ASSOCIATED WITH MORTALITY OR WITHDRAWAL OF LIFE SUSTAINING TREATMENT IN POLYTRAUMA PATIENTS WITH SEVERE TBI

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Introduction: For polytrauma patients with severe TBI, it is unknown whether specific patient or injury factors are associated with higher odds of death or withdrawal of life sustaining treatment (WLST). We hypothesized that patient comorbidities and severe injuries would be associated with a composite outcome (death or WLST) in this group.

Methods: Polytrauma patients (defined as AIS > 2 for head and at least one other body region) were identified from the 2016 TQIP database. Patients who died or were discharged within 24 hours of admission were excluded. Bivariate analysis of patient and injury factors was performed between patients with and without the composite outcome. Logistic regression model was created using significant factors identified from bivariate analysis, and AUC was calculated.

Results: 15,106 patients were included; median age 48 years, 72% male, 97% blunt mechanism of injury, median AIS head of 3, and median ISS of 27. The composite outcome was noted in 2,194 (15%) patients. Bivariate analysis identified age, comorbidities (bleeding disorder, CHF, CKD, and cirrhosis), penetrating mechanism, ISS, and AIS scores for head, neck, thorax, abdomen, and spine as being associated with composite outcome (all $p<0.05$). The logistic regression model identified age, CHF, CKD, cirrhosis, penetrating mechanism, and AIS scores for head, neck, thorax, abdomen, and spine as independent risk factors for composite outcome (all $p<0.05$). History of alcohol abuse, smoking, HTN, and ADHD were protective of the composite outcome (all $p<0.05$). AUC for this model was 0.786.

Conclusions: Age, CHF, CKD, cirrhosis, penetrating mechanism, and severe injuries to head, neck, thorax, abdomen, or spine are independent risk factors for mortality or WLST in polytrauma patients with severe TBI. Providers should identify these patient and injury-related factors present on admission and use these results for prognostication in this severely injured population.

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Poster #108

RE-EVALUATING VTE PROPHYLAXIS IN TRAUMA PATIENTS USING THROMBOELASTOGRAPHY WITH PLATELET MAPPING: IS LMWH REALLY ENOUGH?

Daisy Sanchez MD; Mackenzie Mayhew BS; Bradley Rogers PharmD; Rachele Solomon MPH; Shari Selesky PA-C; Brenda Shaver MBA; Bar Anuiz BS; Sara Hennessy MD; Seong Lee MD; Rafael Sanchez MD; Chauniqua Kiffin MD; Juan Arenas MD; Andrew Rosenthal MD; Paul Pepe MD, MPH; Tjasa Hranjec MD, MS
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Introduction: Despite widespread use of low-molecular-weight-heparin (LMWH) following major trauma, venous thromboembolic events (VTEs) have not been eliminated. We hypothesized that thromboelastography with platelet mapping (TEG-PM) could: (1) better differentiate between patients with and without VTEs, and (2) identify individual's source of hypercoagulability to better tailor anticoagulation treatment.

Methods: TEG-PM was assessed at the time of VTE diagnosis and compared to TEG-PM of patients without VTE, with hospital stay >7 days and injury-related immobility. Patients with catheter or fracture associated thromboses were excluded. Comparisons were made using univariate analysis.

Results: Among 40 patients studied (77.5% male), those in VTE group (n=20) had higher Injury Severity Score, prolonged mechanical ventilation, upper extremity fractures and leukocytosis compared to non-VTE patients (n=20). Lower extremity fractures and pelvic injuries resulting in immobilization were equivalent between the two groups. VTE patients exhibited hypercoagulable TEG parameters (table), despite more frequent use of LMWH, p=0.0285. TEG-PM frequently identified inadequate LMWH dosing and platelet hyperactivity in the VTE group.

TEG factors	DVT [N=20]	No DVT [N=20]	p-value
R			
mean +/- SE	4.6 ± 0.2	6.4 ± 0.3	<0.0001
Median (IQR)	4.6 (4,5)	6.1 (5,8)	0.0003
α			
mean +/- SE	76.4 ± 0.8	72.3 ± 1.5	0.0024
Median (IQR)	76.1 (74,79)	73.1 (70,77)	0.0324
MA			
mean +/- SE	75.7 ± 0.9	72.7 ± 1.9	0.1575
Median (IQR)	76 (74,77)	73 (70,78)	0.2715
MA-AA			
mean +/- SE	74.9 ± 2.2	48.1 ± 4.4	<0.0001
Median (IQR)	78 (73, 81)	55.8 (31,62)	<0.0001
MA-ADP			
mean +/- SE	63.8 ± 3.2	49.5 ± 4.7	0.0157
Median (IQR)	64.5 (60,73)	51.5 (34,68)	0.0478
ActF			
mean +/- SE	37.4 ± 4.1	24.7 ± 2.5	0.0119
Median (IQR)	31 (27,39)	20.5 (17,29)	0.005

Conclusion: Hypercoagulable TEG-PM parameters may: (1) delineate patients at risk for VTE formation following trauma regardless of their immobilization status, and (2) better facilitate individualized, treatment-targeted approach to VTE prophylaxis. TEG-PM may better identify thrombotic mechanisms (hypercoagulable factors or platelets) and even allow for tailored dosing to mitigate VTEs.

Poster #109

THE PREGNANT TRAUMA ACTIVATION - DOES IT AFFECT PERINATAL OUTCOME?

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Background: Trauma during pregnancy is associated with significant maternal and fetal morbidity; however, this morbidity has previously been defined for index hospitalization only. The majority of pregnant trauma activations are discharged home still gravid, and the effect of trauma on subsequent birth outcome remains unknown. The goal of this study was to examine longer term perinatal outcomes of neonates whose mothers met criteria for trauma activation at a level 1 trauma center while pregnant.

Methods: All births at a single hospital with a level 1 trauma center from January 2014 to April 2020 were cross-referenced with the trauma registry to identify patients who were pregnant at the time of trauma activation. Patients already enrolled in the high-risk obstetrics program and those with multiple gestations were excluded from analysis. The group of neonates with maternal prenatal trauma activations (Trauma Neonates) was compared with controls (Non-trauma Neonates).

Results: Among 22,504 births, 239 were identified as Trauma Neonates. Gestational age at time of trauma activation stratified by trimester was 3.3% for trimester 1, 47.7% for 2, and 49.0% for 3. The primary mechanism of injury was motor vehicle crash (72.6%) followed by fall (13.9%). The majority of mothers did not suffer a documentable injury (177: 74.1%). Amongst the 62 mothers with injuries, ICD-10 ISS was 1 (69.4%), 2 (6.5%), 4 (12.9%), 5 (9.7%), and 9 (1.6%). 16 (6.7%) Trauma Neonates were born during the mother's trauma hospitalization. Outcomes of Trauma Neonates were similar to Non-trauma Neonates with respect to preterm delivery 13.8% vs. 11.5%; P=0.273), cesarean section (29.3% vs. 28.7%; P=0.769), birth weight (3270 g vs. 3320 g; P=0.416), APGAR less than 9 at 1 and 5 minutes (40.2% vs. 40.8%; P=0.854; 8.4% vs. 10.0%; P=0.438), NICU admission (13.8% vs. 10.5%; P=0.103), and fetal death (0.4% vs. 1.2%; P=0.284).

Conclusion: At a level 1 trauma center with a high-volume labor and delivery center, perinatal outcomes were not significantly different for babies whose mothers were trauma activations while gravid. Following trauma activation, pregnant patients may be reassured that their pregnancy is unlikely to be adversely affected with respect to birth outcomes.

Poster #110

EFFECTS OF EXTENDED REALITY ON INITIAL CARE OF TRAUMA PATIENTS: THE NASA TASK LOAD INDEX

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Background: Recently, extended reality (XR), which integrates virtual reality, augmented reality, and mixed reality technologies, has been applied to the medical field. However, only a few studies have focused on the effectiveness of XR simulation in the initial care of trauma patients. The authors developed a simulation of initial trauma care using XR and assessed its effectiveness.

Methods: In total, 30 physicians (11 emergency physicians, 3 acute care surgeons, 3 interventional radiologists, and 13 residents) were instructed to view computed tomography (CT) images on a conventional flat-screen monitor to develop a diagnosis and treatment strategy according to the scenario of a severe trauma patient. Then, the same CT images were stereoscopically viewed using the online application Holoeyes MD and projected into the air using a holographic lens. The NASA Task Load Index (TLX) (six items of workload assessment scored on a 11-point Likert scale, with 0–5 being positive and 6–10 being negative) was compared before and after the study.

Results: Comparison of NASA-TLX before and after the simulation showed that positive ratings increased after the simulation for all items (mental demands: 23% vs. 70%, $p = 0.001$; physical demands: 40% vs. 60%, $p = 0.196$; time pressure: 17% vs. 57%, $p = 0.003$; work performance: 34% vs. 80%, $p = 0.001$; effort: 10% vs. 63%, $p < 0.001$; and frustration: 30% vs. 70%, $p = 0.004$).

Conclusions: Simulation of initial care of trauma patients using XR could reduce the workload and enhance the development of diagnosis and treatment strategies for initial care of trauma patients.

Poster #111

EPIDEMIOLOGY OF PEDIATRIC SUICIDE DEATHS IN CONNECTICUT

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Introduction: Suicide, is the second leading cause of death in American children, and firearms are used in up to 42% of completed suicides in this age group. Screening at risk children for depression and suicide and providing children who screen positive with lethal means safety counseling is one promising injury prevention strategy. We reviewed 10 years of Connecticut's pediatric suicide deaths in conjunction with the outcomes of a newly implemented suicide screening questionnaire used in the emergency department at our institution.

Methods: Data from the Connecticut Office of the Chief Medical Examiner and the Department of Public Health were retrospectively reviewed from 2008-2018. All deaths among children ages 10-18 were identified and further classified according to manner of death and other demographic data. Suicide deaths were categorized based on the cause of death and type of injury. We used the Ask Suicide Screening Questions tool in the emergency department. This is a brief validated tool approved by the Joint Commissions. Qualitative and quantitative data from the suicide screening questionnaire was reviewed and quantified from August 2019 to March 2021.

Results: During the study period there were a total of 541 deaths among ages 10-18 in Connecticut, of which 16.2% were suicides. Mean age of suicide death was 15.2+/-1.45. More than half (57%) of suicide deaths were male. Among suicide deaths, the majority (77.9%) were by hanging, and 13.9% were by firearm ($p<.001$). Since the implementation of the suicide screening questionnaire nearly 20,000 children (89% of those registered in the ED) were screened with this tool. Five percent screened positive and were referred for a social work consult. The social worker provided a multitude of additional resources for the youth and family.

Conclusion: Suicide is the third leading cause of death for children in Connecticut, and hanging is the most common means. Further work is needed to develop strategies toward incorporating policies that lower the risk of suicide by hanging into lethal means safety counseling and identifying which mental health resources are most effective at lowering suicide risk.

Poster #112

LEFT OUT IN THE COLD: HOMICIDE AMONGST PERSONS EXPERIENCING HOMELESSNESS

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Introduction: The average life expectancy for a person experiencing homelessness (PEH) is 20-30 years less than the general population, largely attributable to higher rates of chronic diseases. Few studies explore other causes. Our goal was to characterize risk factors that exist for PEH who experience a death by violence in this vulnerable population to drive future intervention.

Methods: We reviewed homicide victims in the National Violent Death Reporting System (NVDRS) from 2003-2017, comparing patients identified as homeless at the time of death to those who were not. We also compared victim demographics, circumstances of death, suspect demographics, and relationship to the victim.

Results: 76,344 incidents were included, with 1196 victims (1.6%) identified as homeless experiencing homicide. PEH were primarily male (85% vs. 78%, $p<0.001$), older (43 vs. 30 yrs, $p<0.001$), and white (41% vs. 30%, $p<0.001$). Mental health issues, alcohol and substance abuse were more often identified in PEH. While firearm was the most common homicide weapon, PEH were more likely stabbed or bludgeoned to death. PEH were more likely killed in a natural area or street/road and were more likely to die through random violence/hand of a stranger.

Conclusion: PEH are older, suffer from mental illness, and tend to be killed in natural areas by strangers. While only 0.17% of the population, they are disproportionately represented at 1.6% of homicides.

	Circumstance	Not Homeless (n=75148)	Homeless (n=1196)	p-value
	Mental health problem	1840 (2.4)	72 (6.0)	<0.001
	Alcohol problem, other substance abuse problem	5952 (7.9)	408 (34.1)	<0.001
	Single homicide only	64536 (85.9)	1145 (95.7)	<0.001
	Random violence	1126 (1.5)	58 (4.8)	<0.001
	Suspect thought to be intoxicated: ETOH or drugs	2140 (3.7)	83 (8.9)	<0.001
Location	House/apartment	38220 (50.9)	248 (20.7)	<0.001
Location	Street, road, sidewalk, alley, public space	23469 (31.2)	695 (58.1)	
Location	Motor vehicle	4876 (6.5)	36 (3.0)	
Location	Supervised residential facility (shelter, etc)	203 (0.3)	25 (2.1)	
Weapon	Firearm	51557 (68.6)	426 (35.6)	<0.001
Weapon	Sharp instrument	9301 (12.4)	260 (21.7)	
Weapon	Blunt instrument	4113 (5.5)	201 (16.8)	
Weapon	Other (fists, hanging, fall, poisoning, etc.)	10,177 (13.5)	309 (25.8)	
Relation	Unknown relationship	19378 (34.0)	396 (42.5)	<0.001
Relation	Stranger	5037 (8.8)	118 (12.7)	
Relation	Acquaintance	12499 (21.9)	277 (29.7)	
Relation	Close relationship (friend, sig other, IPV)	19,093 (25.4)	132 (11.0)	

Groupings may not add to 100% due to truncation for space; denominator different for suspect variable.

Poster #113

MAPPING FIREARM SUICIDE – A WAY TO GUIDE PREVENTION EFFORTS

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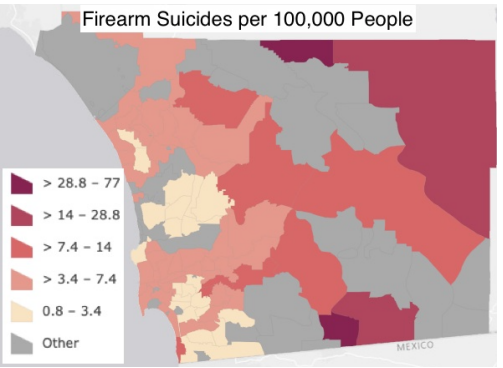
Introduction: Suicides by firearm are a major public health issue in the United States, accounting for over 23,000 deaths in 2017, nearly half the total number of suicides. There are no existing studies that map suicides and provide a geographical analysis that contextualize the demographic groups at risk. We hypothesized that zip codes with higher income would have a lower firearm suicide rate. We also predict there would be an urban and rural split, with firearm suicides occurring more often in rural communities.

Methods: A retrospective review of suicide deaths from a County Medical Examiner from 2011 to 2018, along with demographic data from the United States Census Bureau, was performed. Study population was dichotomized as firearm and non-firearm suicides that occurred in the County. Data was grouped by residential zip code, excluding zip codes with < 3 years of data. These data were mapped using ArcGIS Pro to group suicides by zip codes and townships. Chi-squared analysis was performed to determine the association of suicide method and demographic.

Results: There were 3,299 suicides during the study period, 1,189 of which were by firearm. Of the firearm suicide victims, 34.6% were > 65 years old, and 79.1% were non-Hispanic White. Suicide rates by firearm were significantly higher in males, those > 65 years of age and non-Hispanic Whites. The lowest income quartile (Q1) had the highest firearm suicide rate per 100,000 at 12.4; followed by Q3 at 6.2, Q2 at 5.6, and Q4 at 4.0. ArcGIS mapping demonstrates rural areas had greater firearm suicide rates relative to more urban areas (Figure)



Conclusion: Firearm suicide rates are greatest among older, non-Hispanic White males and in the lowest income quartile. Mapping further contextualized this demographic into suburban and rural communities rather than urban centers providing a target for prevention efforts.

Poster #114

FALLS FROM LADDERS: INJURY PATTERNS AND OUTCOMES

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Introduction: Our contemporary understanding of the impact of falls from ladders remains limited. The purpose of this study was to examine the injury patterns and outcomes of falls from ladders.

Methods: The National Trauma Data Bank was queried for all patients who fell from a ladder (01/2007-12/2017). Participants were stratified into 4 groups according to age: ≤15, 16-50, 51-65, and >65 years. Univariable analyses were performed to compare the injury patterns and outcomes between the groups. Multivariable analysis was used to identify independent risk factors of mortality.

Results: A total of 168,227 patients were included for analysis. Median age was 56 years (IQR: 45-66), 86.1% were male, and median ISS was 9 (4-13). Increasing age was associated with a higher risk of severe trauma (ISS>15: 8.8% vs 13.7% vs 17.5% vs 22.0%, $p<0.001$). Head injuries followed a U-shaped distribution with pediatric and elderly patients representing the most vulnerable groups. Overall, fractures were the most common type of injury, in the following order: lower extremity 27.3%, spine 24.9%, rib 23.1%, upper extremity 20.1%, and pelvis 10.3%. The overall ICU admission rate was 21.5%; however, it was significantly higher in the elderly (29.1%). In-hospital mortality was 1.8%. The risk of death progressively increased with age with a mortality rate of 0.3%, 0.9%, 1.5%, and 3.6%, respectively ($p<0.001$). The strongest predictors of mortality were GCS ≤8 on admission (OR 29.80, 95% CI 26.66 – 33.31, $p<0.001$) and age >65 years (OR 7.75, 95% CI 3.46 – 17.34, $p<0.001$). Only 50.8% of elderly patients were discharged home without health services, 16.5% were discharged to nursing homes and 15.2% to rehabilitation centers.

Conclusion: Falls from ladders are associated with considerable morbidity and mortality, especially in the elderly. Head injuries and fractures are common and often severe. An intensified approach to safe ladder use in the community is warranted.

Poster #115

MINORITY EFFECTS ON NATIONAL AND REGIONAL FIREARM TRAUMA RATES

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Introduction: Gun violence is a serious healthcare epidemic, both in the United States (US) and worldwide. Racial disparities among victims remain a concern. The aim of this study is to describe the overall incidence of firearm-related traumas based on differing racial or ethnic groups in the US.

Methods: A retrospective review of 27,652 cases from 2019 to 2020 at four Level I trauma centers in California, Oregon, Florida, and Oklahoma. Mechanism of injury (MOI) was standardized across all locations. Pearson chi-square tests were used to compare categorical variables and a multivariable logistic regression was made to assess the risk of a gunshot wound (GSW).

Results: A total of 1,591 cases were queried as GSW. After adjusting for covariates, when compared to white people, black patients had a 5 times more risk of getting a GSW (OR=5.761 CI 5.073-6.541, p< 0.001). We further analyzed by states, black patients in Florida had 8 times more risk of getting a GSW followed by 5 times in Oregon, and 2 times in California, and Tulsa. Hispanic vs. non-Hispanic demonstrated no difference. Overall mortality was 8.5%.

Conclusion: Blacks nationally remain disproportionally affected by GSW. This is true regionally, including in states with varying black populations. Further studies on firearm violence and evaluation of targeted prevention strategies are warranted.

Table 1.
Multivariable logistic regression on risk of GSW for black patients

	OR	CI	P value
Florida	8.562	6.117-11.983	<0.001
Oregon	5.761	5.073-6.541	<0.001
California	2.462	1.174-5.164	0.017
Oklahoma	2.097	1.533-2.870	<0.001

Poster #116

PREVENTING THE OTHER TWO-THIRDS: MODIFIABLE FACTORS RELATED TO FIREARM SUICIDES

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Background: Of the nearly 39,000 American firearm deaths each year, nearly two thirds are due to suicide. State firearm legislation has been shown to decrease these fatalities and firearm ownership increases it. However, comprehensive study including other important factors, including behavioral health indicators, gun ownership and access to care is lacking. We hypothesized that state firearm laws limiting weapon access would be associated with reduced firearm suicide (FS) deaths.

Methods: We acquired 2013-2016 state data for FS deaths from the CDC WONDER database. Firearm laws pertaining to weapon access were obtained from the State Firearms Law Database. Depression rates and access to care were obtained from the Behavioral Risk Factor Surveillance System (BRFSS) of the CDC. Population numbers, poverty rates and access to social services (food assistance) were obtained from the American Community Survey (ACS) of the US Census. Gun ownership estimates were retrieved from the RAND State-Level Firearm Ownership database. Univariate panel linear regression with fixed effect for state was performed with firearm suicide rates as the outcome. A final multivariable panel regression with fixed effect for state was then utilized.

Results: 27 states had laws limiting weapon access ($p=0.003$). Over the study period, only four states endured a change in these laws ($p=0.486$); three states gained at least one law while a single state repealed one law. In univariate analysis, laws and reported depression rates were not associated with FS, but social support, access to care and gun ownership were. In multivariable regression, both lack of health insurance (β -0.06, 95% CI -0.10 to -0.02, $p=0.002$) and gun ownership (β 5.39, 95% CI 1.87 to 8.91, $p=0.003$) were associated with FS rates.

Conclusions: During our time period, very few changes occurred in laws limiting weapon access to specific groups and these changes did not correlate to decreased FS. Access to care and social safety net services had little correlation to death rates. Gun ownership had by far the largest association with firearm suicide rates and remains the largest known modifiable target for reducing suicide deaths.

Poster #117

SYNERGISTIC TRAUMA CENTER'S VIOLENCE INTERVENTION PROGRAM ROLE, IN PARTNERSHIP WITH A FAMILY JUSTICE CENTER

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Background: Intentional injuries are the second leading cause of death in the U.S. between the ages of 1 and 44. Those affected may be victims of domestic or non-domestic violence, intimate partner violence, sexual abuse, elder abuse, or attempted suicide survivors. It is key to note that not all injuries are equal, and in fact each one is unique to the victim. Each individual traumatic event is approached best with a multiagency and multidisciplinary approach. Family Justice Center's (FJC) provide this exact service. Trauma Centers are frequently the first haven for victims, and often the first beacon of light to recovery.

Methods: This is a cross-sectional descriptive study of traumatically injured patients that were evaluated in an adult level II trauma center and were referred to a newly established Family Justice Center (FJC). We included cases from confirmed and suspected assault in our study cohort. Known self-inflicted injuries were excluded. All patients meeting the study criteria regardless of age that were seen and evaluated for the period January 1, 2019, to December 31, 2020, were included in the analysis.

Results: Over the two-year study period, there were 255 trauma admissions for intentional injuries, which accounted for 10.4% of the total admissions (N=2,455). Of these patients, 122 (48%) were evaluated and channeled through the Family Justice Center. Despite referral to alternate services, the remaining 133 (52%) had an open judicial case, thus, were not processed through the FJC due to conflict of interest. The mechanisms of injuries of patients that were referred to the FJC (N=122) were mostly assaults (79%), attempted homicide (11%), domestic violence (4%), and other violent crimes (9%). Majority of the patients that were evaluated in the FJC were of the Hispanic race (73%), while the rest were Caucasian (25%), Asian (1%), African American (1%), and others (1%). There were more males than females (58% vs. 28%). Most of the patients were English speaking (80%), while 20% were non-English speakers. The age group 25-59 consisted 65% of the study cohort, 11% were aged <17, 16% were aged 18-24, and 8% were aged <60. 433 individual services were provided to these patients, including follow-up through: phone conversations (n=111), mail (N=21), text messages (N=9), and 192 other services provided through the 35 partnering agencies including but limited to counseling, employment, legal services, housing, education, support groups, and transportation. None of the patients evaluated through the FJC (N=122) were readmitted in the trauma center for violent incidences within the study period.

Conclusion: By collaborating with FJCs, trauma centers and violence intervention programs can pool resources for enabling services to address important social determinants of health, and promote important research. The outcome contributes to a pathway for healing by using the trauma informed care approach, accountability to those at fault, and most importantly prevention of future acts of intentional injuries. With successful benefit to individual cases comes the trickling effects of community improvement. By investigating the collaboration of trauma centers with an FJC, the road to rehabilitation can become exponentially brighter.

Level of Evidence: VI
Key Words: Intentional injuries, violence intervention program, trauma centers, Family Justice Center

Poster #118

TACTICS FOR HEMORRHAGIC SHOCK: A VIRTUAL COURSE AND VISUAL AID FOR IMPROVED RECUSSITATION

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Introduction: Our trauma performance improvement initiative recognized missed treatment opportunities for patients undergoing massive transfusion. To improve patient care, we developed a novel cognitive aid in the form of a poster entitled "TACTICS for Hemorrhagic Shock." We hypothesized that this reference and corresponding course would improve the performance of trauma leaders caring for simulated patients requiring massive transfusion.

Methods: First, residents and physician assistants participated in a one-on-one, distanced, screen-based virtual patient simulation. Next, they watched a short presentation introducing the TACTICS visual aid. They then underwent a similar second virtual simulation during which they had access to the reference. In both simulations, the participants were assessed using a scoring system developed to measure their ability to provide appropriate pre-determined interventions while leading a trauma resuscitation (score range: 0-100%). Pre and post-intervention scores were compared and participants' feedback was obtained anonymously.

Results: Thirty-two participants (21 residents and 11 PAs) completed the course. The median score for the first simulation without the use of the visual aid was 43.8% (IQR 20.8-75.0). Commonly missed treatments included giving tranexamic acid (success rate: 37.5%), treating hypothermia (31.2%), and reversing known anticoagulation (21.8%). All participants' performance improved using the visual aid, and the median score of the second simulation was 89.6% (IQR 70.8-100) (p-value <0.001). Ninety-two percent of survey respondents "strongly agreed" that the TACTICS visual aid would be a helpful reference during real-life trauma resuscitations.

Conclusion: The TACTICS visual aid is a useful tool for improving the performance of the trauma leader and is now displayed in our emergency department resuscitation rooms. This performance improvement course, the associated simulations and visual aid are easily and virtually accessible to interested trauma programs.

Poster #119

TRAUMA VOLUME INCREASED IN LOWER SOCIOECONOMIC COMMUNITIES DURING THE COVID-19 PANDEMIC

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INTRODUCTION: The effects of COVID-19 on trauma incidence were examined widely. Racial/ethnic minority groups bear a disproportionate burden of trauma and adverse outcomes. This study investigated the change in trauma incidence by socioeconomic subgroups during COVID-19.

METHODS: A retrospective study utilizing Level I trauma center registry data (2017-2020) was conducted. Data collection included trauma and demographic characteristics. Home zip codes were matched to the Community Needs Index (CNI), an aggregate socioeconomic score. CNI was dichotomized (<4.4 vs. ≥4.4). The percentage change in weekly trauma incidence was computed for high- vs. low-CNI groups. A bootstrapped chi-square test was performed to compare patients injured in 2020 vs. 2017-19.

RESULTS: Among 13,202 trauma patients, those injured during the COVID-19 pandemic were significantly ($p < 0.005$) more likely to be non-white (48.1% vs. 42.2%), Hispanic (26.1% vs. 21.6%), homeless (3.2% vs. 1.7%), and living in zip codes with CNI ≥ 4.4 (52.4% vs. 49.6%) compared to the pre-pandemic period. The overall weekly trauma incidence for patients from high-CNI areas increased by 6.5% between pre-and post-COVID periods and decreased by 4.8% for patients from low-CNI areas (dashed, Figure 1).

CONCLUSION: At baseline, lower socioeconomic (high CNI) communities bear a disproportionate burden of injuries; this inequity was exacerbated during the COVID-19 pandemic. This study advocates for developing targeted interventions to address inequities among trauma patients.

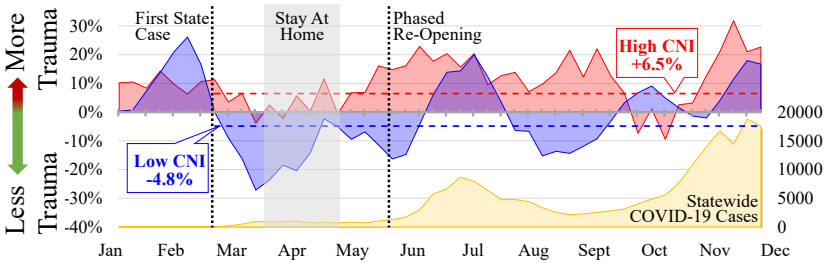

Figure 1. Trauma Volume Percentage Change during COVID-19, 5-week Moving Average (CNI ≥ 4.4, more need; CNI < 4.4, less need)

Poster #120

COVID-19 IMPACT ON OUTCOMES IN EMERGENCY GENERAL SURGICAL PATIENTS: AAST MULTI-INSTITUTIONAL TRIAL

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Medical College of Wisconsin

Introduction: The COVID-19 pandemic has placed additional strain on healthcare systems worldwide, potentially resulting in delayed access to care and late presentations. We hypothesized emergency general surgery (EGS) patients presented with more severe disease in the COVID-19 era and this would be associated with increased morbidity and mortality.

Methods: This is a AAST international multicenter retrospective study of EGS patients age ≥ 18 years admitted during the first 6 months of the COVID-19 pandemic and a control group admitted during the same period one year prior. The primary outcome was postoperative complication rates. Demographics, AAST severity grade, admission SOFA score, and operative information were collected. The COVID-19 era and control groups were compared for severity of presentation and outcomes.

Results: 1,748 patients from 6 centers met our inclusion criteria, of which 898 (51%) were admitted during the COVID-19 pandemic. More severe presentations AAST Grade ≥3) were observed during the COVID-19 era, (34.7% vs 29.4%, p=0.02). COVID-19 era patients did not experience a greater number of overall complications (16.3% vs 15.2%, p=0.53), however there were significantly more cases of acute respiratory distress syndrome (2.2% vs 0.9%, p=0.03). The mortality rate was more than twice as high in patients admitted during the pandemic, but the difference was not statistically significant (2.0% vs 0.9%, p=0.07). There was no difference in the frequency of operative intervention (78% vs 75%, p=0.14). On subgroup analysis, there was no difference in mortality for patients with appendicitis, cholecystitis, diverticulitis, necrotizing soft tissue infection, small bowel obstruction, perforated viscous, or perforated ulcer. Patients with necrotizing soft tissue infections experienced an unplanned return to the operating room more often during the pandemic (20% vs 3%, p=0.03).

Conclusions: Disease severity was higher in EGS patients presenting during the COVID-19 pandemic, suggesting a possible delay in presentation or access to care. These results have significant implications in the ongoing and any future pandemics.

Poster #121

ACUTE CARE SURGEONS' PRACTICES AND ATTITUDES REGARDING ELECTIVE SURGERY

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Maine Medical Center

Introduction: The importance of an elective surgery practice to Acute Care Surgeons (ACS) is evolving. In a survey to assess Trauma group scope of practice in 2008, 201/221(91%) of trauma groups performed some elective surgery, including endocrine surgery 64%, pulmonary lobectomy 31%, Whipple's 55%, and peripheral bypass 24%.

Methods: A survey was designed, approved by our institutional IRB. The survey was sent to 1680 members of AAST via email, asking about the scope and variety of professional activities as well as their attitudes toward the importance of elective surgery in their practices. Responses were maintained in a REDCap database and analyzed using Excel. We defined elective surgery as procedures scheduled in advance, including not only general surgery but other areas of interest such as spine exposure, burn/wound management, vascular access, or reconstructive surgery.

Results: We received 130 complete survey responses (7.7%). 113 of the 130 (87%) worked in hospitals with a surgical residency. 83% practiced in Level 1 and 15% in Level 2 trauma centers. The mean number of years in practice was 15.8 years. 23% of respondents reported performing no elective surgery, 33% of respondents had between 1%-5% of their work time dedicated to elective surgery, 30% of respondents had 6-24% of their work time for elective surgery and 14% of respondents had 25% or more dedicated to elective surgery. The scope of elective surgery in the survey included: General surgery 59%, soft tissue/wound 58%, elective endoscopy/ PEG 34%, elective chest wall reconstruction/rib plating 24%, burn 5%, vascular 3%, vascular access 8%, thoracic 8% spine exposure 12% and endocrine 4%. The amount of elective surgery felt about right to 62% of respondents, too little or far too little to 33% and too much to 5%.

Conclusion: The amount of elective surgery performed by acute care surgeons was less than what was reported in previous studies. 40% of respondents dedicate at least 10% of their work activity to elective surgery. The scope of elective surgeries done by acute care surgeons remains broad though also absolute numbers are decreasing from previous reports. The importance of elective surgery to acute care surgeons remains high for those involved in it, with 33% of acute care surgeons feel like they are doing less than they would like. Defining the importance and extent of elective general surgery has implications for the continuing evolution and training of the next generation of acute care surgeons.

Poster #122

COMPARISON OF EMERGENCY DEPARTMENT POINT OF CARE ULTRASOUND VS RADIOLOGY PERFORMED GALLBLADDER ULTRASOUND

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Introduction: We sought to determine if point of care ultrasound (POCUS) and radiology performed ultrasound (RADUS) were clinically similar in patients presenting to the emergency department with right upper quadrant (RUQ) abdominal pain.

Methods: We retrospectively reviewed all adults presenting at a single institution emergency department between 2000-2020 with complaints of RUQ pain who received POCUS followed by RADUS of the RUQ within a 24-hour period. Ultrasound reports were assigned a score for the following parameters: gallbladder wall thickening, gallstones, pericholecystic fluid. For patients with all six components reported, the total score for POCUS was compared to RADUS using Wilcoxon Signed Rank Test.

Results: Of the 289 patients, 109 (37.7%) underwent a procedure (cholecystectomy or cholecystostomy). Although all patients had POCUS and RADUS exams, only 53% had complete reporting on both. POCUS exams were statistically more likely to report all exam components (84.4% vs 61%, $p<0.001$). Total ultrasound scores for this same group showed that POCUS and RADUS were statistically similar ($n=152$, $p=0.55$). When comparing individual components for all exams, presence of pericholecystic fluid and cholelithiasis were similar between POCUS and RADUS ($p=0.06$, $p=0.23$ respectively). Presence of thickened wall differed between the two modalities ($p<0.001$), however it should be noted that wall thickness measurement was reported less frequently on RADUS (81% vs 94.8%, $p<0.001$).

	POCUS	**RADUS**	**p**
Stones present	189 (66%)	193 (68%)	0.23
Pericholecystic fluid present	62 (24.1%)	37 (17%)	0.06
Wall thickened (>3mm)	98 (35.8%)	109 (46.6%)	<0.001

Conclusion: POCUS and RADUS are similar in patients with RUQ abdominal pain, and the surgeon can be confident using POCUS for assessment of biliary disease. Incomplete reporting of standard ultrasound components is common. ED and Radiology departments should work to standardize ultrasound reporting.

Poster #123

CUMULATIVE SURGICAL MORTALITY RISK IN EMERGENCY GENERAL SURGERY

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Introduction: It is unknown whether having multiple Emergency General Surgery (EGS) procedures performed in one admission confers additional risk. We hypothesized that having multiple procedures (for example hernia repair plus bowel resection) is associated with higher mortality.

Methods: We identified all adults with non-elective admissions who underwent EGS from the 2017 National Inpatient Sample. EGS procedures types identified by ICD-10 code were counted and included: colon, small bowel, hernia, lysis of adhesions, ulcer procedures, gallbladder, debridement, other laparotomy, and other laparoscopy. We used logistic regression to determine the association between the number of EGS procedures performed and in-hospital mortality, adjusting for: age, sex, payer, race and the Elixhauser comorbidities. Patients with a single procedure was the reference group. Median [IQR], and odds ratios [95% CI] are presented.

Results: 216,317 EGS patients (age 57 [43-70], 50.6% female) were included; 2.8% died. Of these, 33,744 (15.6%) had >1 EGS. Patients with multiple procedures, compared with patients who had 1 procedure, were more likely to die (7.4% vs. 1.9%, $p<0.001$). There was a dose-response relationship whereby having more EGS procedures during a hospitalization was associated with higher odds of death (Table).

Conclusions: Patients who need more than one type of procedure have increased odds of mortality. Four or more procedure types was associated with a 5-fold and higher increase in odds of death.

Table. Logistic Regression

# of EGS Procedures	Odds Ratio	95% CI	P > | z |
2	3.04	2.86 - 3.24	0.00
3	3.92	3.54 - 4.33	0.00
4	5.74	4.83 - 6.83	0.00
5	7.64	5.38 - 10.86	0.00
>5	9.53	4.92 - 18.49	0.00

*Odds Ratios, Adjusted for age, sex, payer, race, Elixhauser count

Poster #124

EFFECTS OF AGE AND GENDER ON WORK-LIFE BALANCE SATISFACTION AMONG TRAUMA SURGEONS

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Introduction: As physician burnout rates have been on the rise, there is an increased focus on how best to mitigate this problem. Because dissatisfaction with work-life balance (WLB) is associated with burnout, improving this balance is a topic that has gained recent popularity. Our study aimed to evaluate the factors associated with WLB in trauma surgeons when stratified by age and gender.

Methods: This was a secondary analysis, based on age (>/= 50 and < 50) and gender, of a AAST survey study investigating factors associated with WLB in trauma surgeons. The survey included detailed questions regarding demographics, clinical practice, family, lifestyle, and emotional support. Each subgroup was analyzed separately and the primary outcome for each group was WLB satisfaction.

Results: Among the 292 (21%) AAST members that completed the original survey, the population was stratified by age [143 older (49%), 149 younger (51%)] and gender [85 females (29%), 207 males (71%)]. The table below shows factors independently associated with satisfying WLB for each subgroup after logistic regression controlling for other variables.

Females	Males	Older (>/=50)	Younger (<50)
-Spending more awake hours at home -Current job well suited to them -Better at meeting deadlines	-Saying 'no' to new tasks -Fair compensation -Healthy diet -Feeling emotionally supported at work	-Working less hours per week -Having hobbies -More years in practice - Saying 'no' to new tasks -Fair compensation -Getting exercise -More vacation time	-Working less hours per week -Having hobbies -Current job well suited to them -Better at meeting deadlines

Conclusions: Factors independently associated with a satisfying WLB in trauma surgeons are comparatively different when stratified by age and gender. This information may be useful to help trauma surgeons understand what factors they can modify in order to improve WLB and avoid burnout. In addition, department chairs and division chiefs should be aware that factors affecting WLB among their trauma surgeons are quite different depending on age and gender of the individual surgeon.

Poster #125

GLOBAL SURGERY PARTNERSHIPS IN LOW- AND MIDDLE-INCOME COUNTRIES: AAST MEMBERSHIP SURVEY

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Introduction: The growing field of global surgery has led institutions in high-income countries (HICs) to establish partnerships with institutions in low- and middle-income countries (LMICs). There is a lack of understanding as to what these partnerships entail. Our objective was to characterize the collaborations between American Association for the Surgery of Trauma (AAST) members' institutions and their LMIC partners.

Methods: A cross-sectional, internet-based global surgery partnership survey was distributed to the AAST membership listserv (1,504 members) between June and August 2020. Respondents from United States (U.S.)-based institutions who completed the survey were included. Responses representing the same institutional partnerships were combined for analysis.

Results: A total of 58 AAST members representing 52 unique U.S. institutions in the Northeast (n=13, 25%), Midwest (n=14, 27%), West (n=13, 25%), and South (n=12, 23%) were included. Nearly two-thirds (n=34, 65%) reported their institution had partnerships or opportunities in LMICs, with sub-Saharan Africa (79%) being the most commonly reported region. LMIC partnerships were more common among university-affiliated compared to community or private institutions (88% vs. 61%, p=0.023), and most commonly supported educational efforts (93%), research (74%), and clinical rotations (70%). Surgical disciplines of focus were most commonly general surgery (88%), trauma/critical care (59%), and pediatric surgery (38%). A small number (21%) described their institutions' international activities as mission trips. Reciprocal opportunities, such as training or research, were available in roughly half (47%) of the partnerships, but only two (6%) responded LMIC partners could rotate at their U.S. institution.

Conclusion: Among AAST members' institutions, most existing partnerships with LMICs were education- or research-focused. Reciprocal opportunities for LMIC partners were less common, suggesting more work is needed to ensure these HIC-LMIC partnerships are equitable, collaborative, and driven by LMIC stakeholder priorities and needs. As global surgery partnerships grow in number, AAST members could leverage the organization's network and resources to work toward this goal.

Poster #126

OUTCOMES OF TOTAL VERSUS PARTIAL COLECTOMY IN FULMINANT CLOSTRIDIUM DIFFICILE COLITIS. A PROPENSITY MATCHED ANALYSIS

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Background: The Total Abdominal Colectomy (TAC) is the recommended procedure for Fulminant Clostridium Difficile Colitis (FCDC), however, occasionally, FCDC is also treated with partial colectomies. The purpose of the study was to identify the outcomes of partial colectomy in FCDC cases.

Method: The National Surgical Quality Improvement Program (NSQIP) database was accessed and eligible patients from 2012 through 2016 were reviewed. Patients 18 years and older who were diagnosed with FCDC and who underwent colectomies were included in the study. Patients' demography, clinical characteristics, comorbidities, mortality, morbidities, length of hospital stay and discharge disposition were compared between the group who underwent partial colectomy and the group who underwent TAC. Univariate analysis followed by propensity matching were performed. A p value of <0.05 is considered as statistically significant.

Results: Out of 491 patients who qualified for the study, 93 (18.94%) patients underwent partial colectomy. The pair matched analysis showed no significant difference in patients' characteristics and comorbidities in the two groups. There was no significant difference found in mortality between the two groups (30.1% vs. 30.15, $P>0.99$). There were no differences found in the median [95% CI] hospital length of stay [LOS] (23 days [19-31] vs. 21 [17-25], $P=0.30$), post-operative complications ($P>0.05$), and discharged disposition to home (43.1% vs. 33.8%) or transfer to rehab (21.55 vs. 12.3%, $P=0.357$) between the TAC and partial colectomy groups.

Conclusion: The overall 30 days mortality remains very high in FCDC. Partial colectomy did not increase risk of mortality or morbidities and LOS.

Poster #127

PRE-MORBID FRAILTY PREDICTS WORSE QUALITY OF LIFE IN EMERGENCY GENERAL SURGERY

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Introduction: Patient frailty is recognized as a key determinant of poor surgical outcomes. It is unclear how frailty affects health-related quality of life (HRQoL) in emergency general surgery (EGS). We hypothesized frail EGS patients would report lower baseline HRQoL and higher rates of anxiety and depression.

Methods: We performed a single-center, prospective, longitudinal study of patients admitted with an EGS diagnosis. Frailty was assessed by grip strength, an EGS specific survey and psoas diameter. Frailty status at baseline was used to determine an association, if any, with baseline HRQoL using the SF-36 Physical Component [PCS] and Mental Component Summary [MCS]), assessment of activities of daily living (ADLs; Katz Index and Lawton Scale), anxiety (Generalized Anxiety Disorder Assessment; GAD7) and depression (Patient Health Questionnaire; PHQ9).

Results: 46 patients (52yo +/- 14.4; 66% female) admitted with an EGS diagnosis were included and 31 (68%) required surgery. 46% of the patients were classified as frail by their frailty index score. Baseline SF-36 (PCS for frail =24.0; MCS for frail =26.5), Katz Index (5.1 vs 5.9, p =.03), Lawton Scale (6.7 vs 7.8, p =.035) were lower for frail patients on admission compared to non-frail patients. Similarly, frail patients had higher scores for anxiety (10.8 vs 5.8, p =.01) and depression (11.5 vs 6.6, p =.02). After controlling for age and gender, frailty was significantly associated with a lower PCS (-9.26, 95%CI -16.2, -2.4) and MCS (-21.4, 95% CI -34.1, -8.7). Similarly frail patients had lower ADLs, -.787 (95% CI -1.5,-.11) on the Katx Index and -1.1 (95%CI -2.1, -.09) on the Lawton Scale. Finally, frailty was significantly associated with increased anxiety (GAD +6.1, 95%CI 2.6, 9.6) and depression scores (PHQ9 +6.5, 95%CI 2.7, 10.3).

Conclusion: Frail patients have lower quality of life compared to non-frail counterparts on admission to hospital with emergency general surgery conditions. This may aid in the discussion of management options with a patient focus, particularly for invasive therapies such as surgery. Frailty should be measured in at-risk patients admitted to hospital with an EGS condition. Future work is needed to determine the impact of frailty on post-hospitalization quality of life, anxiety and depression.

Poster #128

THE IMPACT OF THE FIRST COVID-19 WAVE ON THE PRESENTATION AND MANAGEMENT OF PATIENTS WITH ACUTE APPENDICITIS

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Introduction: Acute appendicitis (AA) is the most common surgical emergency, with a relatively stable yearly incidence and an inelastic treatment demand. During the first wave of the COVID-19 pandemic, New York City (NYC) hospitals saw a marked decrease in patients presenting with non-COVID-related diseases. The objective of this study was to characterize the effects of the pandemic on the incidence, presentation, and management of AA.

Methods: A retrospective analysis of patients with AA who presented to two academic medical centers during the NYC COVID peak (March 22nd - May 31st, 2020) was performed. This group was compared to a control cohort of patients who presented during the same period in 2019. Primary outcomes included the incidence of AA, complicated disease, and operative vs. non-operative management (NOM). Secondary outcomes included duration of symptoms (DOS), hospital length of stay (HLOS), and complication rates. Statistical analyses were performed using Mann-Whitney U, Chi-square, and Fisher's exact tests.

Results: A 49.1% reduction in the incidence of AA was seen between 2019 (n=114) and 2020 (n=58). Median DOS doubled from one day in 2019 to two days in 2020 ($p<0.02$). Proportionally, the incidence of complicated appendicitis rose from 19.3% in 2019 to 41.4% in 2020 ($p<0.005$). 32.4% of patients with uncomplicated AA underwent NOM in 2020, compared to 12% in 2019 ($p<0.02$). Although three early recurrences were seen in each NOM group, HLOS and complication rates were similar between years.

Conclusion: The COVID-19 pandemic had a direct effect on the hospital presentation of patients with AA, including an overall decline in visits and delays to care, which likely contributed to a higher proportion of complicated disease. Surgeons were also more likely to treat AA with antibiotics alone than they were prior to the pandemic. Further research is needed to understand the long-term consequences of these changes in management.

Poster #129

TIME TO SURGICAL INTERVENTION AFFECTS MORTALITY, COMPLICATIONS, REOPERATIONS, AND READMISSIONS OF EMERGENCY GENERAL SURGERY PATIENTS: A NATIONWIDE ASSESSMENT

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The impact of time to surgery on outcomes of Emergency General Surgery (EGS) patients has not been well studied. We hypothesized that prolonged time from admission to surgical intervention is associated with worse outcomes following low and high risk EGS procedures.

Using the NSQIP database (2013-2017), 9 procedures encompassing 80% of the burden of EGS diseases, performed on an urgent/emergent basis were identified and further classified as low risk (open and laparoscopic appendectomy and laparoscopic cholecystectomy) and high risk (open cholecystectomy, laparoscopic and open colectomy, lysis of adhesions, perforated ulcer repair, small bowel resection, and exploratory laparotomy). The impact of time from admission to surgery on outcomes (mortality, complications, reoperations and 30-d readmissions) was analyzed by univariate and multivariate models.

Of a total of 226,083 patients enrolled, 8% underwent surgical management at or later than 3 days post admission, which was associated with significantly increased mortality (13.8%), complications (22.4%), reoperations (8.3%) and 30-d readmissions (7.2%) when compared to surgical care within the first day of admission. Comparing the impact of surgical care delivered on Day 1 vs. Day 3 on mortality, increase of 5.4-fold was observed for appendectomy, 1.9-fold for laparoscopic cholecystectomy, 1.4-fold for open colectomy, 2-fold for perforated ulcer repair, 1.8-fold for small bowel resection, and 1.2-fold for exploratory laparotomy. Similar results were observed for complications, reoperations, and readmissions.

In conclusion, the described EGS-related outcomes worsen as time from admission to surgery increases, regardless of procedure risk. In fact, the most affected procedure by delaying the operation was appendectomy. Timely surgical intervention remains a cornerstone of high quality EGS care.

Poster #130

IMPACT OF INCREASED USE OF ENDOVASCULAR AND HYBRID TECHNIQUES FOR VASCULAR TRAUMA IN THE AAST PROOVIT REGISTRY

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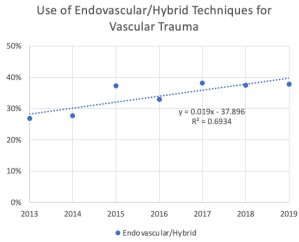
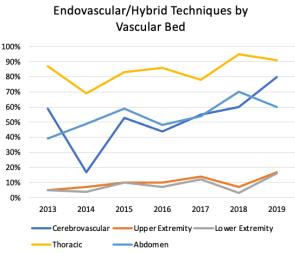
Background: Contemporary management of vascular trauma is undergoing a paradigm shift, and more surgeons are undergoing dual training in both trauma and vascular surgery in order to master both skill sets. However, there is a paucity of data on the utilization of endovascular/hybrid ("endo") techniques across all vascular beds.

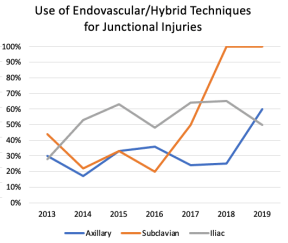
Methods: Patients in the AAST PROOVIT registry from 2013-2019 with repair of arterial injuries were queried. Injuries to radial, ulnar, and tibial arteries were excluded. The primary aim was to evaluate changes in the use of endo operative techniques over time as well as their use by body region (cerebrovascular, thoracic, abdominal, upper extremity, lower extremity). A subset analysis was performed to evaluate these trends specifically for "junctional" injuries (subclavian, axillary, iliac).

Results: 3372 patients (76% male) were enrolled in the registry. Overall treatment type was 42% nonoperative, 44% open, 14% endo. Excluding nonoperative; endo repair increased an average of 2% per year from 2013-2019 (Range: 17-35%, R^2 =.61). This increase for junctional injuries was 5% per year (Range: 33%-63%, R^2 =.89). Endo repairs were most common for thoracic, abdominal, and cerebrovascular injuries, and least likely in upper and lower extremity injuries. Injury severity score (ISS) was higher for endo repairs in every vascular bed except for lower extremity and mortality was lower in thoracic & abdominal. For junctional injuries ISS was 25 vs 21 (p=.003) and mortality was 19% vs 29% (p=.099) for endo vs open repairs.

Conclusion: Use of endovascular and hybrid techniques for management of vascular trauma continues to evolve and expand, especially for junctional injuries, resulting in lower mortality. These findings demonstrate the need for access to novel endovascular technology and hybrid operating rooms for the management of vascular trauma. Importantly, this trend implies the need for an evolution in training paradigms to provide these skills for trainees who plan to treat vascular trauma.







Poster #131

IS REBOA TRULY CONTRAINDICATED IN THE ELDERLY? AN ANALYSIS OF THE AAST AORTA REGISTRY

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Introduction: The indications for the use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in trauma patients continue to evolve. While it has been suggested that the extremes of age may be a relative contraindication for its use, there is no clear evidence supporting this claim. We compared REBOA open AO via resuscitative thoracotomy (RT) in this population.

Methods: We conducted a retrospective cohort study using the AAST AORTA registry (11/2013-11/2020). We included all trauma patients older than 65 years who arrived in the emergency department with signs of life who subsequently required AO. The study groups were defined according to management strategy, either REBOA or RT. The primary outcome was in-hospital mortality. Secondary outcomes were HLOS, ICU LOS, major and minor complications, and need for delayed amputation. Logistic regression analysis was performed to compare outcomes between the groups.

Results: There were 87 elderly patients who underwent RT and 104 who underwent REBOA. The mean age was similar between the groups. (72±10.5 vs 73±12.1, p=0.451). RT patients were more likely to sustain penetrating trauma (19.5% vs 6.7%, p=0.025) and had higher ISS (29±26.0 vs 35±20.5, p=0.023). However, there were no significant differences in the incidence of severe trauma (ISS>15: 25.0% vs 20.5%, p=0.523) and hypotension on admission (90.0% vs 73.5%, p=0.473). REBOA patients were more likely to survive and proceed to hemorrhage control procedures (61.5% vs 32.2%, p<0.001) and had longer HLOS and ICU LOS. On regression analysis, there was no increased mortality among REBOA patients (OR 1.24, 95% CI 0.34-2.79). Similarly, there were no differences in major complications (OR 0.87, 95% CI 0.62-1.87) or delayed amputation (OR 0.86, 95% CI 0.34-1.17). REBOA patients were more likely to develop minor complications (OR 1.22, 95% CI 1.00-2.31).

Conclusion: REBOA in elderly patients was not associated with increased mortality or higher rate of major complications and these patients were more likely to survive to attempts at subsequent hemorrhage control procedures compared to RT with AO.

Poster #132

POPLITEAL ARTERY INJURY: IS ENDOVASCULAR MANAGEMENT MAKING A DIFFERENCE?

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Background: Popliteal artery injury (PAI) remains one of the most morbid peripheral vascular injuries with significant risk of limb loss. There is an increasing utilization of endovascular techniques for vascular trauma, but their role in PAI remains unknown. We compared outcomes for PAI managed with open or endovascular surgery using data from the National Trauma Databank (NTDB).

Methods: Trauma patients aged 16 years and older who experienced an isolated lower extremity injury were identified using ICD codes from the NTDB (2007–2017). Patients were included if they experienced a PAI and required surgical repair, classified as open repair, endovascular repair, or both. Trauma centers were categorized as Level I, Level II, or Level III. Survival analysis was performed to evaluate the association between repair type and amputation.

Results: We identified 6,058 patients for study. The majority of patients underwent open repair (91.9%), followed by both endovascular and open (4.2%), and endovascular repair (3.8%). The overall amputation rate was 15.1%. There was an increasing trend of endovascular repair over the study period (0.8% in 2007 to 5.3% in 2017, trend $p = 0.015$). Mean times to initial operation were 7.0 and 17.9 hours for open and endovascular repair respectively. After stratification by center, multivariable analysis revealed no difference in amputation risk by repair type.

Conclusion: Endovascular management of PAI increased, but required subsequent open repair in the majority of cases. Endovascular management also did not reduce the need for fasciotomy or amputation, calling into question both its appropriateness and effectiveness as a minimally invasive procedure for PAI. Open surgical repair appears to remain the preferred management option for PAI.

Poster #133

PREPERITONEAL PELVIC PACKING VERSUS ANGIOEMBOLIZATION FOR SEVERE PELVIC FRACTURES: A NATIONWIDE STUDY

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Introduction: Preperitoneal pelvic packing (PPP) and angioembolization (AE) are hemorrhage control procedures used for severe pelvic fractures. However, data comparing patient outcomes from such procedures is scarce.

Methods: This is a 3-year retrospective cohort study using the American College of Surgeons Trauma Quality Improvement Program database from January 2016 to December 2018. We included adult (≧16 years) trauma patients with severe pelvic fractures (AIS ≧3) who underwent PPP or AE within 4 h of hospital admission. In propensity score-matched (1:1) patients, in-hospital mortality rates were compared between PPP and AE groups using Kaplan–Meier analysis.

Results: Of a total of 1265 patients with severe pelvic fractures, 243 (19.2%) underwent PPP and 1022 (80.8%) underwent AE. Concomitant hemorrhage control laparotomy was performed in 81% and 27% of PPP and AE patients, respectively. In 394 propensity score-matched patients, a significant difference in the mortality rate between PPP and AE was not found (35.5 vs. 30.5%, $p = 0.335$).

Conclusion: While severe pelvic fractures were managed with PPP or AE with similar mortality rates, their indications appeared significantly different. Further prospective studies are warranted to determine indications for PPP and AE as hemorrhage control procedures for severe pelvic fractures.

Table. Characteristics, types of other procedures and outcomes of pelvic fracture patients between PPP and AE

	Before PSM			After PSM		
Variable	**PPP (n=243)**	**AE (n=1022)**	**P-value**	**PPP (n=197)**	**AE (n=197)**	**SMD**
Age, y	37 (25-53)	47 (31-62)	**<0.001**	37 (26-55)	37 (25-57)	6.4
Sex (Male), n %	171 (70)	750 (73)	0.337	136 (69)	139 (71)	3.3
sBP	106 (80-124)	106 (84-129)	0.327	108 (83-127)	109 (87-131)	6.7
HR	110 (85-132)	107 (86-129)	0.244	111 (85-132)	112 (92-131)	5.8
RR	20 (17-24)	20 (16-24)	0.245	20 (18-25)	22 (18-28)	9.9
GCS	14 (3-15)	14 (6-15)	0.083	14 (4-15)	14 (7-15)	0.9
ISS	34 (25-43)	34 (27-43)	0.126	34 (25-43)	34 (27-43)	5.6
Other procedures, n (%)						
None	29 (12)	645 (63)	**<0.001**	27 (14)	26 (13)	-1.5
Laparotomy	190 (81)	274 (27)	**<0.001**	157 (80)	159 (81)	2.6
Thoracotomy	10 (4.3)	21 (2.1)	0.061	9 (4.6)	8 (4.1)	-2.6
Extremity	5 (2.1)	52 (5.1)	0.055	4 (2.0)	4 (2.0)	0
Outcomes						**P-value**
Transfusion 24H (Unit)	11 (6-18)	7 (4-14)	**<0.001**	12 (6-19)	12 (7-25)	0.202
In-hospital mortality, n (%)	88 (36.2)	236 (23.1)	**<0.001**	70 (35.5)	60 (30.5)	0.335

Poster #134

THE AAST KIDNEY INJURY GRADE DOES NOT EQUALLY PREDICT INTERVENTIONS IN PENETRATING AND BLUNT TRAUMA

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Introduction: The American Association for the Surgery of Trauma (AAST) kidney injury grading scale has been validated to predict mortality, nephrectomy, renorrhaphy, and angioembolization. AAST kidney injury grade is the same regardless of mechanism of injury.

Methods: A 5-year retrospective review of all kidney injuries at an urban, level-one, trauma center was performed.

Results: 143 patients were included (36 blunt/64% penetrating). Nephrectomy was performed in zero blunt trauma victims. Angiography was used in 12% of blunt patients; 0%/9%/13%/9%/67% by AAST Grade I-V ($p=0.03$). Embolization was used in 0% of Grades I-III, 9% of Grade IV and 33% of Grade V ($p=0.05$). Cystoscopy and stenting were used in 27% of Grade IV injuries and 0% of other grades ($p=0.02$).

In penetrating trauma victims, nephrectomy was performed in 4% of AAST I-III injuries, 58% of grade IV injuries, and 86% of grade V injuries ($p<0.001$). Angiography was used in 9% of penetrating patients with a similar rate per AAST Grade I-V (NS). Embolization was used in 0% of Grade I-III, 6% of Grade IV, and 6.9% of Grade V injuries (NS). Cystoscopy (8%) and ureteral stenting (6%) were used similarly across all grades (NS). Distribution of procedures by AAST grade was dissimilar between penetrating and blunt trauma in nephrectomy ($p<0.001$), cystoscopy ($p=0.09$), and stenting ($p=0.07$).

Conclusion: In blunt trauma, increasing AAST grade is associated with angiography, embolization, cystoscopy, and stenting rates, but not nephrectomy. Renal salvage in more severe blunt trauma utilizes embolization (Grade IV/V) and ureteral stenting (Grade IV). In penetrating trauma, increasing AAST grade is associated with higher nephrectomy rates. Nonoperative methods of renal salvage in penetrating trauma appears similar, regardless of grade. On a AAST grade-by-grade basis, blunt and penetrating trauma patients are not treated similarly.

Poster #135

ARE TRAUMATIC ABDOMINAL WALL HERNIAS AN INDICATOR OF INJURY SEVERITY AND THE NEED FOR EMERGENT LAPAROTOMY

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Introduction: Traumatic abdominal wall hernias (TAWH) are relatively uncommon and non-operative management at initial presentation is reported as safe and practical. The sheering force that results in fascial disruption, however, could indicate an increased risk of visceral injury. The aim of our study was to evaluate whether the presence of a TAWH was associated with intra-abdominal injury requiring emergent laparotomy.

Methods: The trauma registry of a busy urban level I trauma center was queried (1/2012 - 12/2020) for adult patients with blunt thoracoabdominal trauma diagnosed with a TAWH. Demographics, mechanism of injury, ISS, BMI, length of stay, TAWH size, type of TAWH repair and outcomes were analyzed. Chi-Square, ANOVA single-factor, and two-tailed T-tests with descriptive statistics were performed; $P< 0.05$ was considered significant. Univariate analysis was used to compare outcomes in the groups.

Results: Overall, 38,749 trauma patients were admitted over the study period, of which 62 (0.16%) had a TAWH. Types of hernia included: lumbar (n=51, 82%) flank (n=9, 15%), and rectus (n=2, 3%). Patients were commonly male (n=37, 60%); the median age was 35 years (range 16–79 years) and an ISS of 20 (IQR 20). Motor vehicle collisions (MVC) were the most common (58%). Patients 'seat location at impact did not determine TAWH laterality (p=0.109). In general, BMI was associated with pelvic fractures (p=0.0241) and defect size (p=0.0314), with the larger defects observed in BMIs >30. Seatbelt sign (p=0.0455), defect size (p=0.0340), and ISS (p=0.000784) were indicative of an emergent laparotomy (40%). A minority of TAWHs (16%) were repaired at index operation, primary repair (8%), and mesh 18% (6 biologic vs. 5 synthetic). Failed expectant management occurred in 6 (10%) patients. Overall mortality was 5%, with no deaths related to the hernia whether operative or nonoperative.

Conclusion: TAWHs are associated with increased intra-abdominal injury requiring emergent laparotomy for other life-threatening injuries. Further investigation is needed to identify which seriously injured patients benefit from immediate or delayed repair of a TAWH.

Poster #136

EMERGENCY ANGIOGRAPHY AND SUBSEQUENT ACUTE KIDNEY INJURY IN SEVERELY INJURED TRAUMA PATIENTS

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Introduction: Angiography has been conducted as a hemostatic or diagnostic procedure for trauma patients for several decades, and indications for angiography after injury continue to expand. While several complications, such as tissue necrosis after embolization, have been reported, little is known regarding subsequent kidney injury due to contrast media. To elucidate whether emergency angiography would introduce kidney dysfunction in trauma victims, we compared the incidence of acute kidney injury (AKI) between patients who underwent emergency angiography and those who did not.

Methods: A retrospective cohort study was conducted using a nationwide trauma database (2004-2019), and adult trauma patients were included. The indication of emergency angiography was determined by both trauma surgeons and radiologists, and AKI was diagnosed by treating physicians based on a rise in serum creatinine and/or fall in urine output according to any published standard criteria. Incidence of AKI was compared between patients who underwent emergency angiography and those who did not. Propensity score matching was conducted to adjust baseline characteristics including age, comorbidities, mechanism of injury, vital signs on admission, Injury Severity Scale (ISS), degree of traumatic kidney injury, surgical procedures, and surgery on the kidney, such as nephrectomy and nephrorrhaphy.

Results: Among 230,776 patients eligible for the study, 14,180 underwent emergency angiography. The abdomen/pelvis was major site for angiography (10,624 [83.5%]) and embolization was performed in 5,541 (43.5%). Propensity score matching selected 12,724 pairs of severely injured patients (median age, 59; median ISS, 25). While the incidence of AKI was rare, it was higher among patients who underwent emergency angiography than in those who did not (140 [1.1%] vs. 67 [0.5%]; odds ratio = 2.10 [1.57–2.82]; $p < 0.01$). The association between emergency angiography and subsequent AKI was observed regardless of vasopressor usage or injury severity in subgroup analyses.

Conclusion: Emergency angiography in severely injured trauma patients is associated with increased incidence of AKI.

Poster #137

OBESITY AND ITS COMPLEX EFFECTS ON OUTCOMES AFTER PENETRATING ABDOMINAL TRAUMA

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Introduction: Studies have correlated obesity with increased morbidity and mortality after trauma. In penetrating trauma, some studies suggest obesity has a more negligible effect. We hypothesize resuscitation in obese patients is sometimes inadequate and may contribute to poor outcomes. We assessed differences in presentation, management and outcomes of penetrating trauma patients by BMI.

Methods: We evaluated adult penetrating abdominal trauma patients in the 2017 Trauma Quality Improvement Program (TQIP) database. Exclusion criteria were death within 1 hour of admission, missing data on BMI, or significant extra-abdominal injuries (Abbreviated Injury Score (AIS) ≥ 2 for any other body region). We categorized BMI per CDC guidelines. We defined hemodynamic instability as blood transfused within 4, or 24 hours or those with SBP < 90 on presentation.

Results: 4778 cases, with 61% of patients between age 21-40. 88% were male. Stratified by BMI, 1785 (37%) were normal-weight, 1531 (32%) were overweight, 787 (16%) were Obese class I, 339 (7%) were Obese class II, and 237 (5%) were Obese class III. No significant association between hypotension on presentation and BMI was found. No clear differences in the type of surgery for hemorrhage control were found between differing BMI groups. Hospital length of stay (LOS) ($p=0.0001$), ICU LOS ($p=0.0054$), and total time on ventilator ($p=0.0324$) all significantly increased as BMI increased. Disposition was associated with BMI ($p=0.0074$), with highest mortality rate for Obese class II (4.4%).

Conclusions: We found significantly worse outcomes in obese patients after penetrating abdominal injury. While baseline demographics and AIS were similar, obese patients had increased comorbidities which may have contributed to their poorer outcomes. Obese patients had increased hospital LOS, ICU LOS, ventilator days, and mortality. Inadequate resuscitation may contribute to this difference. Therefore, more granular studies may help determine optimal resuscitation strategy and delineate risk for obese penetrating abdominal trauma patients.

Poster #138

RENAL SALVAGE IS THE BEST OPTION FOR OPERATIVE MANAGEMENT OF LOW GRADE RENAL INJURIES

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Introduction: The majority of renal injuries are managed nonoperatively. When operative intervention is required, surgeons must choose between total nephrectomy (TN) or renal salvage (RS), understanding that leaving a patient with single kidney is associated with worse long-term outcomes. However, little is known about short-term outcomes between these two options. We hypothesized that RS is associated with worse short-term outcomes than TN.

Methods: We performed an analysis of the 2017-2018 National Trauma Data Bank using ICD-10 codes to identify patients who underwent TN or RS. The groups were propensity score matched for age, gender, mechanism, admission blood pressure, GCS, and ISS and further stratified by grade of injury, low (I-III) vs. high (IV-V). The primary outcome was mortality and secondary outcomes included hospital and ICU length of stay (LOS), ventilator days, acute kidney injury (AKI), inpatient dialysis, percutaneous drain placement, ureteral stent placement, delayed nephrectomy and total blood transfusions.

Results: After matching, we identified 344 patients with high-grade (IV-V) and 428 patients with low-grade (I-III) renal injuries who underwent surgical intervention. Outcomes of TN vs. RS are shown in the table. There was no difference in LOS and ventilator days between the two groups.

Conclusion: RS should be performed in patients with low grade injuries as it is associated with improved mortality and avoids long term morbidity associated with a single kidney. Caution should be used applying RS to high grade injuries, as there was a non-statistically significant two-fold increase in mortality.

	High Grade Injury			Low Grade Injury		
	TN (n=172)	RS (n=172)	p value	TN (n=214)	RS (n=214)	p value
Mortality	9 (5%)	17 (10%)	0.10	30 (14%)	14 (7%)	0.01
Acute Kidney Injury	13 (8%)	17 (10%)	0.44	26 (12%)	19 (9%)	0.27
Dialysis	4 (2%)	3 (2%)	0.99	9 (4%)	4 (2%)	0.16
Percutaneous Drain	12 (7%)	5 (3%)	0.08	19 (9%)	12 (6%)	0.19
Ureteral Stent	4 (2%)	15 (9%)	0.009	3 (1%)	14 (7%)	0.007
Delayed Nephrectomy	0 (0%)	9 (5%)	0.004	0 (0%)	7 (3%)	0.01
24 Hour Transfusion (mL)	594±1764	958±2908	0.23	623±1792	987±3441	0.25

Poster #139

RISK FACTORS FOR LEAK AFTER INTESTINAL RECONSTRUCTION IN DAMAGE CONTROL LAPAROTOMY

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Introduction: Intestinal injuries are frequent among patients treated with a damage control laparotomy (DCL). The incidence of intestinal reconstruction leak (IRL) and associated risk factors are not completely understood.
We studied the influence of the trauma severity, surgical technics and damage control strategies used for bowel repair as part of damage control on IRL.

Methods: Patients 15 years and older, with hollow viscus injuries who required a DCL and survived more than 48 hours, treated at our Level I Trauma Center between 2011 and 2019 were included. Associations were analyzed by multiple logistic regression (MLR).

Results: One hundred twenty-five patients were included; 113 (90.4%) of them were male. Median, interquartile range (IQR) age was of 29 (23-39) years. Trauma mechanism was penetrating in 114 subjects (91.2%). Small bowel injury was present in 90 cases (72.0%) and in colon 76 (60.8%). The Median (IQR) of NISS and ATI were 41 (29 - 50) and 28 (18- 39), respectively.
In the index surgery, the small bowel was managed with primary repair in 33 cases (37.5%), stoma construction in 1 (1.1%), and resection and discontinuity (R&DC) in 54 (61.4%). There were 28 cases (42.4%) of primary repair in colon, colostomy in 6 (9.1%), and R&DC in 32 (48.5%).
The ligated bowel was reconstructed by hand-sewn anastomosis in 33 cases (44%) and by stapled anastomosis in 42 (56%). Two models of MLR were analyzed

	OR	95% CI	p
Anatomic & physiologic model			
Combined colon & Small bowel	21.21	4.26 – 105.54	<0.001
Pancreatic injury	11.54	2.64 – 50.40	0.001
Cardiovascular SOFA on day 2	1.53	1.08 – 2.15	0.016
Surgical technique model			
Multiple ligation	6.14	1.33 – 28.32	0.02
Handcrafted vs commercial VAC	1.11	0.39 – 3.15	0.84
Sewn vs stapled anastomosis	2.28	0.98 – 5.33	0.06

Table. MLR models for risk of LIR in damage control laparotomy

The combination of colon and small bowel injury, a pancreatic injury and the persistence of cardiovascular dysfunction after 48 hours were associated with IRL. The MLR model which explored the technical aspects, identified multiple resections as a risk factor.

Conclusion: Independent risk factors for intestinal repair leak were a colon and small bowel combined injuries, associated pancreatic injury, and persistent cardiovascular dysfunction. The only technical aspect identified was the need for multiple resections of the intestine.