Session XVI: Quickshot Session I 1-13
Paper QS-1: 9:10 AM - 9:16 AM

MODIFIED ABBREVIATED BURN SEVERITY INDEX AS A PREDICTOR OF IN-HOSPITAL MORTALITY IN PATIENTS WITH INHALATION INJURY: DEVELOPMENT AND VALIDATION USING INDEPENDENT COHORTS

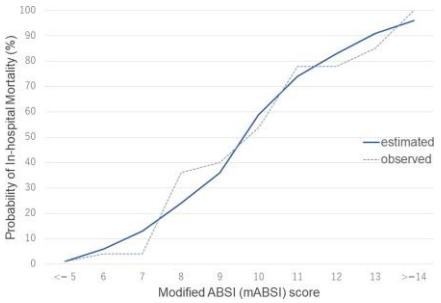
RYO YAMAMOTO MD, TAKAYUKI SHIBUSAWA MD, TOMOHIRO KURIHARA MD,Ph.D., NAOKI AIKAWA* MD,Ph.D., JUNICHI SASAKI MD,Ph.D., Keio University

Invited Discussant: Glen Franklin, MD

Introduction: The ability to accurately evaluate the severity of inhalation injury can help optimize patient care and facilitate research on novel treatments. Currently, as there is no accepted severity grading system for inhalation injury, we have developed and validated a new scale, the modified Abbreviated Burn Severity Index (mABSI), using independent cohort data.

Methods: We screened a large database from a multicenter observational registry and identified patients with inhalation injury. The inclusion criteria were age ≥ 15 years, presentation with palpable pulse, and supplemental oxygen or mechanical ventilation requirement. Patients with missing survival data were excluded. After patient data were divided into development and validation cohorts, missing values were replaced with multiple imputation. In the development cohort, 12 potential predictors were analyzed using multivariate logistic regression to identify prognostic variables for in-hospital mortality and scores were assigned to each predictor based on odds ratios. In the validation cohort, the mABSI was analyzed using receiver operating characteristic (ROC) curve and mABSI-derived probability of in-hospital mortality was compared with observed mortality rate.

Results: We randomly assigned 1,377 and 919 patients to the development and validation cohorts, respectively. Age, self-inflicted injury, cutaneous burn area, and mechanical ventilation requirement were identified as independent predictors, and mABSI was developed with a possible score range of 1–17. The scale has a high discriminatory power based on area under the ROC curve (0.94; 95% confidence interval = 0.92–0.97; $p <$ 0.01), which is higher than other scaling systems, such as prognostic burn index and ABSI. Both estimated and observed probability of in-hospital mortality gradually increased stepwise from 1% at score ≤ 5 to almost 100% at score ≥ 14 with linear calibration plots (Figure).



Conclusion: We have developed and validated mABSI, a novel index that accurately estimates the severity of and predicts in-hospital mortality.

Session XVI: Quickshot Session I 1-13
Paper QS-2: 9:16 AM - 9:22 AM

A THREE-YEAR RETROSPECTIVE MULTI-CENTER STUDY ON TIME TO SURGERY AND MORTALITY FOR ISOLATED GERIATRIC HIP FRACTURES

Allen Tanner MD, Stephanie Jarvis MPH, Alessandro Orlando MPH, Nnamdi Nwafo MD, Robert Madayag MD, Benoit Blondeau MD, Chad Corrigan MD, Matthew Carrick* MD, Pamela Bourg Ph.D.,RN, David Bar-Or MD, Penrose Hospital

Invited Discussant: Vanessa Ho, MD, MPH

Background A body of literature has reported on the effect of time to surgery on mortality and morbidity of geriatric hip fracture patients; it remains unclear if earlier surgery is associated with improved mortality. Previous studies have found that hip fracture surgery ≤ 24 hours of admission decreases hospital length of stay (HLOS), which often equates to greater financial burden. The purpose of this study was to determine if early surgery (≤ 24 hrs.) is associated with mortality rates and total hospital costs in geriatric patients with isolated hip fractures admitted to four level 1 trauma centers.

Methods This was a multicenter retrospective observational study. Patients, aged ≥ 65 years, admitted at 4 level 1 trauma centers (January 2014-December 2016) for isolated hip fractures were included. Patients were dichotomized into two groups, early surgery (defined as surgery ≤ 24 hours from admission) or delayed surgery (> 24 hours from admission). The primary outcome was mortality, assessed in-hospital, at three-months, six-months, and one-year using the Centers for Disease Control and Prevention (CDC) National Death Index (NDI) data; only exact mortality matches were included. Secondary outcomes included HLOS (days), in-hospital complications, and total hospital cost (indirect and direct costs). Total hospital cost did not include professional provider billing to the patient. Statistical analyses included chi-squared, Fishers exact test, Kruskal-Wallis, Student's t-tests, linear mixed-effects regression (by facility), and step-wise logistic regression; an alpha of 0.05 was used.

Results There were 968 patients included, 669 (69%) in the early group and 299 (31%) in the delayed group. The early group had more females (70% vs. 58%, p<0.001) than the delayed group. Comorbidities were comparable across study arms. There were a higher proportion of patients in the early group (19%) with an American Society of Anesthesiologists (ASA) score of two than in the delayed group (12%), p=0.03; other ASA scores were similar. The median (IQR) time to surgery was 13.5 hours (6.8-18.5) for the early group and 34.4 hours (27.3-45.1) for the delayed group. After adjustment for sex, the delayed group were 1.4 times (0.7, 3.0) as likely as the early group to have died at one year; however, this was not significant, p=0.31. Mortality rates were not significantly different across study arms at any point. In-hospital complication rates were comparable between groups. The LS mean difference (95% CI) for HLOS was 1.0 day (0.6, 1.3) longer for the delayed group, when compared to the early group, p<0.001, after adjustment for ASA score. In a subset analysis of total hospital cost at 3 level 1 trauma centers (725 patients; 196 delayed and 529 early), the delayed group was on average (95% CI) $2,550 ($1,400, $3,750) more expensive than the early group (p<0.001), after adjustment for ASA score.

Conclusions The results of this study provide further evidence that surgery within 24 hours of admission is not associated with lower odds of death when compared to surgery after 24 hours of admission, even after adjustment. Other than increasing HLOS and total hospital cost, delayed surgery did not appear to adversely affect in-hospital complication rates or mortality. If causally linked, our data are 95% confident that earlier treatment for the 196 patients who received delayed surgery could have saved a maximum of $735,000.

Mortality % (n)	Early n=669	Delayed n=299	OR (CI)	P	Adjusted OR (CI)	P
In hospital	1% (8)	2% (6)	1.7 (0.6, 5.0)	0.33	N/A	N/A
Three month[1]	9% (60)	10% (31)	1.2 (0.7, 1.9)	0.49	1.3 (0.5, 3.1)	0.62
Six month[1]	11% (72)	13% (39)	1.2 (0.8, 1.9)	0.30	1.4 (0.6, 3.3)	0.39
One year [2]	15% (100)	18.4% (55)	1.3 (0.9, 1.8)	0.18	1.4 (0.7, 3.0)	0.31

OR: Odds ratio, CI: confidence interval, p: p-value, 1: adjusted for American Society of Anesthesiologists (ASA) Score, 2: Adjusted for sex and congestive heart failure (CHF). Variables available for the model: admit service, sex, pre-injury anticoagulants, admitting facility, ASA score, hip consult, and the comorbidity CHF.

Session XVI: Quickshot Session I 1-13

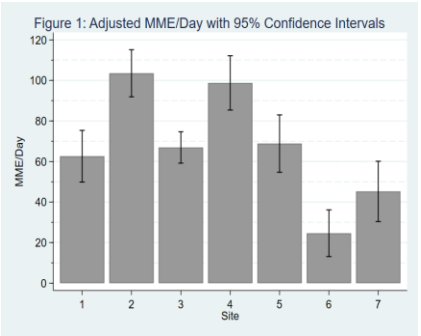
Paper QS-3: 9:22 AM - 9:28 AM

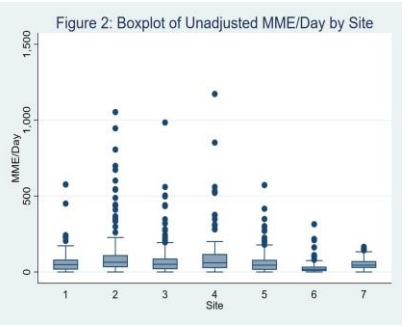
Opioid Prescribing in United States Trauma Centers: a Multi-Center, Prospective, Observational Study

John A. Harvin* MD, MS, Charles E. Green Ph.D., LaDonna Allen RN, Jason Murry MD, John J. Radosevich PharmD, James N. Bogert* MD, Patrick B. Murphy MD,MPH, MSc, Brandy B. Padilla-Jones MD, Ben L. Zarzaur* MD,MPH, John R. Taylor MD, Kevin W. Sexton MD, Cassandra Decker BA, Thomas J. Schroeppel* MD, MS, Charles E. Wade* Ph.D., Lillian S. Kao* MD, MS McGovern Medical School At UT Health

Invited Discussant: Greta Piper, MD

Introduction: Strategies to address the opioid epidemic have primarily focused on prescribing practices in elective surgery. Little is known about prescribing practices in trauma centers. To design effective interventions in trauma centers, the source and magnitude of prescribing variability must be better understood. The purpose of this project was to quantify variability of opioid use between and within trauma centers.
Methods: Consecutive patients admitted to adult trauma services after injury at 7 U.S. centers (5 Level 1, 2 Level 2) during a 2 month period were enrolled. The primary outcome was average morphine milligram equivalents per day (MME/day). To quantify MME/day variation, a multilevel generalized linear model was created adjusting for the *a priori* selected variables Injury Severity Score (ISS) and prior opioid use. To determine the source of variation, an intracluster correlation coefficient (ICC) was calculated.
Results: During the study period, the centers enrolled 1,731 patients. Significant differences between centers were observed in age, sex, race/ethnicity, history of prior opioid use, mechanism of injury, and ISS. Center adjusted mean MME/day ranged from 25 (95% CI 13-36) to 104 (95% CI 92-115) ($p<0.001$, Figure 1). The ICC was 7.0% (95% CI 2.4%-18.8%) suggesting that only 7% of the variation in the model was due to between center differences and the majority of variation in the model (93%) was due to within center differences. Figure 2 is a boxplot of the unadjusted MME/day by Site, graphically depicting the within-center variation ($p<0.001$).





Conclusion: While variation existed between trauma centers, with the greatest difference being 79 MME/day (equivalent to roughly 10, 5mg oxycodone pills/day), the majority of the overall variation was actually within each center. Therefore, global interventions to reduce opioid prescribing across trauma centers are less likely to be effective. Rather, interventions should be tailored at each trauma center to minimize surgeon-level variation and to address patient-specific characteristics.

Session XVI: Quickshot Session I 1-13

Paper QS-4: 9:28 AM - 9:34 AM

HOW SOON IS TOO SOON: OPTIMAL TIMING OF SPLIT-THICKNESS SKIN GRAFT FOLLOWING POLYGLACTIN 910 MESH CLOSURE OF THE OPEN ABDOMEN

Richard H. Lewis, Jr MD, John P. Sharpe MD, Martin A. Croce* MD, Timothy C. Fabian* MD, Louis J. Magnotti* MD, University of Tennessee Health Science Center - Memphis

Invited Discussant: Richard Miller, MD

Introduction: Various management strategies exist for the abdomen that will not close. At our institution, these patients are managed with polyglactin 910 mesh followed 14 days later (LATE) by split-thickness skin graft (STSG) or, in some cases, earlier (EARLY: <14 days), if the wound is judged to be adequately granulated. The purpose of this study was to evaluate the impact of STSG timing for wounds felt ready for grafting on STSG failure.

Methods: Consecutive patients over a 3-year period managed with polyglactin 910 mesh followed by STSG were identified. Patient characteristics, severity of injury and shock, time to STSG, and outcomes, including STSG failure, were recorded and compared. Multivariable logistic regression analysis was performed to identify predictors of graft failure.

Results: 61 patients were identified: 31 EARLY and 30 LATE. There was no difference in severity of injury or shock between the groups. STSG failure occurred in 11 patients (9 EARLY vs 2 LATE, $p<0.0001$). Time to STSG was significantly less in patients with graft failure (11 vs 15 days, $p=0.012$). In fact, after adjusting for age, injury severity, severity of shock and time to STSG, multivariable logistic regression identified EARLY STSG (OR 1.4; 95%CI 1.1-1.8, $p=0.020$) as the only independent predictor of graft failure.

Conclusion: Appearance of the open abdomen can be misleading during the first 2 weeks following polyglactin 910 mesh placement. EARLY STSG was the only *modifiable* risk factor associated with graft failure. Thus, for optimal results, STSG should be delayed at least 14 days after polyglactin 910 mesh placement.

Session XVI: Quickshot Session I 1-13

Paper QS-5: 9:34 AM - 9:40 AM

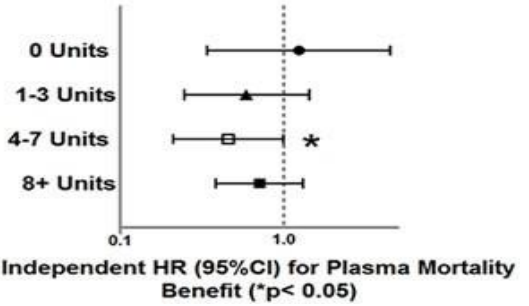
SEVERITY OF HEMORRHAGE AND THE SURVIVAL BENEFIT ASSOCIATED WITH PLASMA: RESULTS FROM A RANDOMIZED PREHOSPITAL PLASMA TRIAL

Vincent Anto BS, Frank Guyette MD,MPH, Joshua Brown* MD, MCS, Brian Daley* MD, Richard Miller* MD, Brian Harbrecht* MD, Jeffrey Claridge* MD, Herb Phelan* MD, A. Tyler Putnam* MD, William Witham* MD, Matthew Neal* MD, Raquel Forsythe* MD, Brian Zuckerbraun* MD, Jason Sperry* MD,MPH, University of Pittsburgh

Invited Discussant: Jennifer Gurney, MD

Introduction: Recent randomized clinical trial evidence demonstrated a survival benefit with the use of prehospital plasma in patients at risk of hemorrhagic shock. It remains unknown whether this survival benefit exists in patients who require massive transfusion and whether the benefit varies with the severity of hemorrhagic shock. We sought to characterize the survival benefit associated with prehospital plasma relative to the blood transfusion requirement over the initial 24 hours. We hypothesized that the beneficial effects of prehospital plasma would be most robust in those with higher severity of hemorrhage.

Methods: We performed a prespecified secondary analysis using data derived from a prospective randomized prehospital plasma trial. Subjects of this trial included patients with hypotension (SBP<90mmHg) and tachycardia (HR>108) or severe hypotension (SBP<70mmHg) in the prehospital arena. Red cell and blood component transfusion were recorded over the initial 24 hours. Massive transfusion (MT) was defined a priori as receiving ≥ 10 units of red cells in 24hrs. We evaluated the relationship between MT and 24 hour red cell transfusion volume with the effect of prehospital plasma on 30-day mortality utilizing Cox Hazard regression and adjusting for all important confounders including prehospital shock and injury severity.



Independent HR (95%CI) for Plasma Mortality Benefit (*p< 0.05)

Results: There were 501 patients included in this analysis with 230 randomized to prehospital plasma with 104 patients requiring MT. Mortality in patients who received MT were higher compared to those that did not (42% vs 25% p<.01).Cox hazard regression demonstrated no significant 30-day mortality benefit of prehospital plasma for MT patients (HR 0.743, 95% CI 0.381- 1.451, p=0.384) while those who received less than MT demonstrated a mortality benefit (HR 0.55, 95% CI 0.34-0.88 p=0.01). When 24hr red cell transfusion was divided into quartiles, there was a significant independent association with survival in the patients who received 4-7 units (HR 0.22, 95% CI 0.06-0.80, p=0.048, Figure). Mortality and measurements of coagulopathy significantly increased with higher red cell needs.

Conclusion: The survival benefits of prehospital plasma was only demonstrated in patients with red cell requirements below the transfusion level of MT. Patients who received 4-7 units of red cells demonstrated the most robust independent survival benefit attributable to prehospital plasma transfusion. Prehospital plasma may be most beneficial in those patients with moderate mortality and coagulopathy risk.

Session XVI: Quickshot Session I 1-13

Paper QS-6: 9:40 AM - 9:46 AM

RIGHT INTO THE DANGER ZONE: COMPLICATIONS OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA) AT ZONE 1 AND 3 FROM THE AAST AORTIC OCCLUSION FOR RESUSCITATION IN TRAUMA AND ACUTE CARE SURGERY (AORTA) TRIAL

Megan Brenner* MD, MS, Bishoy Zakhary MPH, Raul Coimbra* MD,Ph.D., Jonathan Morrison MD, Thomas Scalea* MD, Laura Moore* MD, Jeanette Podbielski John Holcomb* MD, Kenji Inaba* MD, Jeremy Cannon* MD, Mark Seamon* MD, Chance Spalding* MD, Charles Fox* MD, Ernest Moore* MD, Joseph Ibrahim MD, AAST Multi-Institutional Trials Committee

Invited Discussant: Marc DeMoya, MD

Introduction: REBOA adoption and implementation is increasing exponentially, and little is known regarding complications of this new procedure in trauma.
Methods: De-identified data of patients who received REBOA Zone 1 (distal thoracic aorta) and 3 (distal abdominal aorta) was obtained from the AAST database from September 2013-December 2018. Patients were excluded if they received REBOA at Zone 2 or if successful aortic occlusion (AO) was not achieved. Primary outcomes were mortality and complications. Binomial logistic regression was performed for significant variables and validated using Hosmer & Lemeshow test.
Results: 468 patients were identified; mean age was 43±18 years, most patients were male (77%), mean injury severity score (ISS) was 34±16, and blunt mechanisms of injury (MOI) predominated (76%). Mean systolic blood pressure (SBP) at the time of REBOA was 77±28mmHg which increased by a mean of 41±32mmHg after AO. Mean time from admission to AO was 51±63mins, and mean duration of AO was 50±53mins. Overall in-hospital mortality was 57%; 91% for those with ongoing cardiopulmonary resuscitation (CPR) at time of aortic occlusion (AO), and 46% for those without. Acute kidney injury (AKI) was the most common complication overall (19%), followed by pneumonia (11%) and acute respiratory distress syndrome or acute lung injury (ARDS/ALI). 314 patients received REBOA at Zone 1, and 154 at Zone 3. Admission SBP, ISS, SBP at time of AO and after AO, admission lactate and hemoglobin, volume of blood products transfused, and tranexamic acid (TXA) use was similar between Zone 1 and 3 patients. Access complications were also similar between groups, and distal embolism and extremity ischemia were the most common at rates of 4.5 and 4.1%, respectively. Zone 3 patients had higher in-hospital survival (34% vs Zone 1 62%, $p<0.001$) despite longer durations of AO (59$\pm$64mins vs Zone 1 46$\pm$47mins, $p=0.02$) and a higher incidence of ARDS/ALI (14% vs Zone 1 8%, $p=0.032$). Regression analysis demonstrated Zone 1 patients are 3 times more likely to die when controlling for age, gender, SBP at the time of AO, MOI, volume of transfusions, and duration of AO than Zone 3 patients ($p=0.008$).
Conclusion: REBOA at Zone 1 and 3 results in similar rates of access complications. Despite similar physiology at the time of AO and a shorter duration of AO, Zone 1 patients have a higher in-hospital mortality rate than Zone 3 patients. Regardless of supra- or infra-renal occlusion and duration of AO, mitigating ischemia and/or reperfusion insults to the kidneys and lungs should be a priority to help improve outcomes in this population of severely injured patients.

Session XVI: Quickshot Session I 1-13 Paper
QS-7: 9:46 AM - 9:52 AM

THROMBOELASTOGRAPHY (TEG) VS. CONVENTIONAL CLOTTING TEST: WHICH TEST ACCURATELY PREDICTS INCREASED BLEEDING RISK IN A RABBIT HEMORRHAGIC SHOCK MODEL

Bijan S. Kheirabadi Ph.D., Rodolfo J. Deguzman Jr., MBA, Nahir Miranda MS, Irasema B. Terrazas MS, Amber N. Voelker MS, Michael A. Dubick* Ph.D., US Army Institute Of Surgical Research

Invited Discussant: Mitchell Cohen, MD

Introduction:TEG provides a complete measure of the whole blood clotting process and currently is used to guide transfusion strategy for patients with traumatic bleeding and those undergoing procedures with high risk of bleeding. Conventional clotting tests are standard measures of the integrity of the extrinsic and intrinsic clotting pathways performed on platelet-poor plasma. We measured coagulation changes by these *in vitro* methods and *in vivo* bleeding times in the rabbits subjected to tissue trauma, hemorrhagic shock (HS) and resuscitated with blood or plasma components.

Methods:Midline laparotomy (soft tissue trauma) to expose liver lobes was performed on IV anesthetized spontaneously breathing NZW rabbits (3.2±0.3kg). ~40% of rabbits' blood volume was then removed from their jugular veins inducing severe HS (MAP=20-25 mmHg). 15 min after shock, rabbits were randomly resuscitated with a small volume (12.5 mL/kg) of rabbit fresh whole blood (FWB), rabbit thawed plasma (FFP), or 5% human albumin solution (ALB) to a hypotensive target MAP of 60 mmHg (n=8/grp) and monitored for 2hr. Bleeding times (from liver punctures) were measured before hemorrhage and 10min after resuscitation. Subsequently, rabbits were fully resuscitated, receiving autologous blood (Hct ≥34%) and LRS, surgically repaired and recovered overnight. Blood samples were obtained at baseline, 10-min after limited resuscitation and after operation and analyzed for ABG, CBC and coagulation values using conventional and TEG methods. TEG analysis was done by adding recombinant tissue factor (Innovin) to freshly collected blood samples (no anticoagulant) in triplicate.

Results:Following tissue trauma and hemorrhage, rabbits' lactate and base deficit levels were increased to 8.4 ±2.3 and 12.4±2.5 mM, respectively, with no difference among groups. Small volume resuscitation raised the MAP and stabilized the rabbits for 2 hrs. Bleeding times increased (38%) after resuscitation with ALB and FFP but did not change with FWB. Significant increases were measured in PT (4-8%) and aPTT (10-32%) in blood samples of all rabbits after surgery ($p<0.05$ vs. baseline). Fibrinogen concentration however was reduced only in ALB group. Platelet count decreased ~30% in all three groups ($p<0.05$ vs. baseline). TEG analysis of post-resus and post-op blood samples showed shorter R-times (21%) and K-times (46%) and larger α angles (19%) and no change in MA in all groups.

Conclusion:Conventional clotting tests and *in vivo* bleeding time results collectively indicated development of a hypocoagulable state following hemorrhage and resuscitation in all rabbits consistent with refractory bleeding seen during suturing of the abdominal wall. In contrast, TEG data consistently showed faster clotting processes (i.e., hypercoagulable state) of all blood samples irrespective of resuscitative fluids. This discrepancy between conventional tests and TEG has also been reported in some clinical studies. In this animal model with 100% overnight recovery, conventional coagulation tests better reflected increased bleeding risks than TEG.

Session XVI: Quickshot Session I 1-13
Paper QS-8: 9:52 AM - 9:58 AM

SMALL BOWEL OBSTRUCTION MANAGED WITHOUT HOSPITAL ADMISSION: A SAFE WAY TO REDUCE TIME IN THE HOSPITAL?

Joy D. Hughes MD, MICHELLE J. BERNING BS, Alexander W. Hunt BS, Eric J. Finnesgard BS, Donald H. Jenkins* MD, MARTIN D. ZIELINSKI* MD, Mayo Clinic - Rochester

Invited Discussant: Andre Campbell, MD

Introduction:

The management of small bowel obstruction (SBO) has evolved to include the gastrografin challenge (GGC). Additionally, the development of an Emergency Department Observation Unit (EDOU) at our institution in November of 2016 presented an opportunity to avoid hospital admission for select SBO patients who did not meet criteria for immediate operative exploration. We hypothesized that utilization of the GGC protocol in the EDOU in SBO patients would reduce cost and the total time spent in the hospital (including ED) without compromising outcomes.

Methods:
IRB approval was obtained to review patients evaluated with a diagnosis of SBO from January 2014 to December 2018. Patients meeting criteria for immediate exploration were excluded, as well as those who did not receive GGC. Decision for patient inclusion in EDOU protocol was at the attending surgeon's discretion. Readmission was defined as 30 days from evaluation; EDOU SBO recurrences within 30 days were automatically admitted. Time-stamps from ED intake to dismissal (from ED or hospital) and time to operation were extracted. Hospital duration was calculated in hours. Cost data was extracted in dollars and savings reported as percentage in order to protect proprietary cost information. Patients treated in the EDOU were compared to those admitted to the hospital.

Results:
Overall, 125 patients were included (69 +/- 14.3 years*;* 51% female). There were 46 patients (37%) in the EDOU group and 79 (63%) in the admission group. Hospital duration was reduced among EDOU patients by a median of 58.7 hours (EDOU median 23.6 hours with IQR 17.7-159.4, with admission patients' median 82.2 hours with IQR 59.92-162.7, $p<0.01$). Median time from ED intake to OR was statistically similar for EDOU vs. admission patients ((23.5 hours, IQR 10.8-24.5 hours vs 61.8 hours, IQR 33-118 hours, $p=0.06$). Readmission rates were similar for EDOU and admission (6.5%) vs 18.4%, $p=0.054$). EDOU patients had 63% (IQR 45%-65%, $p=0.02$) lower cost of care. A similar percentage of patients underwent exploration; (13% vs 25%, $p=0.09$) . There were no strangulations in either group.

Conclusion:

Management of highly selected SBO patients without criteria for immediate operative exploration using the EDOU GGC protocol was associated with decreased total cost. Additionally, duration of hospitalization was lower in EDOU GGC patients compared to universal hospital admission for the GGC. EDOU utilization did not appear to affect complications, need for surgical intervention or readmissions allowing for expansion of this practice.

Session XVI: Quickshot Session I 1-13
Paper QS-9: 9:58 AM - 10:04 AM

IMPACT OF DELTA SYSTOLIC BLOOD PRESSURE AFTER REBOA PLACEMENT IN NON-COMPRESSIBLE TORSO HEMORRHAGE PATIENTS: AN ABOTRAUMA REGISTRY AND AORTA DATABASE ANALYSIS

Juan Duchesne* MD, Tal Horer MD, Megan Brenner* MD, Kristofer Nilsson MD, David McGreevy MD, Tomas Jacome* MD, Todd Rasmussen* MD, Joseph DuBose* MD, Juan Duchesne* MD, Tulane School of Medicine

Invited Discussant: Terence O'Keeffe, MD

Introduction:Resuscitative endovascular balloon occlusion of the aorta (REBOA) is becoming a standardized adjunct in management of Non-compressible Torso Hemorrhage (NCTH). Guidelines have been developed to help guide the best location and indications for REBOA utilization. No studies have addressed the significance of change in systolic blood pressure (ΔSBP) after REBOA insufflation. We hypothesized a direct correlation between ΔSBP and mortality.
Methods:This was an international, multicenter retrospective review of all patients managed with REBOA from the ABOTrauma Registry and the AORTA database. A non-responder was defined as a hypotensive patient with systolic blood pressure (SBP) < 90 mmHg after REBOA placement with full aortic occlusion. ΔSBP was defined as the difference between pre- and post-REBOA insertion SBP. Significance was set at $P < 0.05$.
Results:The cohort included 542 patients, primarily male (74%), blunt injured (77%) with median age 40 (27 – 58) and ISS 34 (25 – 45). 20% (n = 107) were non-responders. Demographic and injury descriptors did not differ between groups. Overall mortality was 47% and was significantly higher in non-responders vs responders (64% vs 46%, respectively; $P = 0.001$). Non-responders had lower median pre-insertion SBP (50mmHg vs 67mmHg; $P < 0.001$) and lower ΔSBP (20mmHg vs 48mmHg; $P<0.001$).
Conclusion:REBOA non-responders present and remain persistently hypotensive and are more likely to die than responders, indicating a direct correlation between ΔSBP and mortality. Future studies are needed to further elucidate the significance of ΔSBP on mortality and its impacts on damage control resuscitation efforts.

Table. Multivariable logistic regression of association between injury characteristics and risk of becoming a non-responder

Descriptor	OR	95% CI	P
Age	0.993	0.975 – 1.012	0.484
Injury Severity Score	1.024	1.000 – 1.049	0.053
Abdominal injury	0.451	0.214 – 0.951	0.036
Thoracic injury	0.635	0.298 – 1.354	0.240
Head injury	1.206	0.575 – 2.530	0.621
Penetrating injury	1.426	0.509 – 3.998	0.500
Pre-hospital CPR	0.836	0.346 – 2.020	0.691
SBP pre-insertion	0.982	0.972 – 0.992	0.001
Inflation time (minutes)	0.988	0.977 – 1.000	0.042

Session XVI: Quickshot Session I 1-13
Paper QS-10: 10:04 AM - 10:10 AM

EVALUATION OF AGE-ADJUSTED SYSTOLIC BLOOD PRESSURE AND SHOCK INDEX FOR PEDIATRIC TRAUMA TEAM ACTIVATION

Elissa K. Butler MD, Jonathan I. Groner* MD, Monica S. Vavilala MD, Saman Arbabi* MD,MPH, Frederick P. Rivara MD,MPH, Harborview Injury Prevention And Research Center, University Of Washington

Invited Discussant: Barbara Gaines, MD

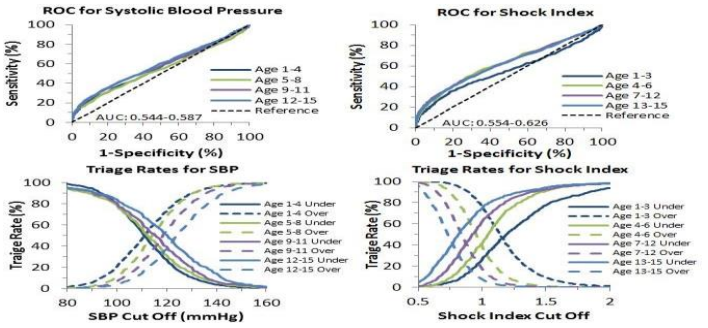
Introduction: Age-adjusted hypotension (SBP-AA) is one of six minimum criteria recommended by the ACS Committee on Trauma for pediatric trauma team activation. However, there is growing evidence that age-adjusted shock index (SIPA, heart rate/SBP) is more accurate than SBP-AA in triaging injured children. Cutoffs for SBP-AA and SIPA are based on published normal vital signs and may not minimize undertriage or overtriage. The objective of this study was to determine the optimal SBP and SIPA cutoffs using receiver operator curves (ROC) for early critical resource use.

Methods: Using the TQIP dataset, children 1-15 years were randomly split into two groups. The independent variables were lowest SBP and highest HR in the field or emergency department. ROC analysis was performed on the first sample to determine the maximum area under the curve (AUC) cut point for SBP-AA and SIPA to predict early critical resource use defined as: transfusion within 4h, advanced airway management within 4h, angiography within 4h, pericardiocentesis within 24h, intracranial pressure monitoring within 24h, major operation within 24h, and/or death within 24h. Using the second sample, undertriage and overtriage rates of SBP-AA and SIPA were determined and compared to standard SBP-AA (<70+2*age for age<10, <90 for age 10-15) and SIPA cutoffs (>1.2 for age 1-6, >1 for age 7-12, and >0.9 for age 13-15).

Results: A total of 87,810 children with median age 8 (IQR: 5-12) years and median injury severity score 5 (IQR: 4-9) were included. The optimal cut point for SBP-AA was 109, 112, 114, and 119 mm Hg for ages 1-4, 5-8, 9-11, and 12-15 years, respectively (AUC
0.544-0.587). The optimal cut point for SIPA was 1.23, 1.02, 0.90, and 0.78 for ages 1-3, 4-6, 7-12, and 13-15 years, respectively (AUC 0.554-0.626; see figure). SIPA had slightly lower undertriage (47.5% vs. 50.9%) and overtriage (34.9% vs. 39.5%) rates than SBP-AA. The ROC-determined SBP-AA had lower undertriage (50.9% vs. 92.7%), but higher overtriage (39.5% vs. 0.7%) rates than the standard SBP-AA. The ROC-determined SIPA had lower undertriage (47.9% vs. 62.7%), but higher overtriage (38.2% vs. 18.7%) rates than the standard SIPA.

Conclusion: In maximizing AUC, the ROC-determined cut points for SBP-AA and SIPA were higher than the standard cut points,
resulting in reduced undertriage at the cost of increased overtriage. Both SBP-AA and SIPA performed poorly in determining early critical resource need. Appropriate triage of the pediatric trauma patient must rely on other criteria in addition to vital sign criteria.

Conclusion: In maximizing AUC, the ROC-determined cut points for SBP-AA and SIPA were higher than the standard cut points,resulting in reduced undertriage at the cost of increased overtriage. Both SBP-AA and SIPA performed poorly in determining early critical resource need. Appropriate triage of the pediatric trauma patient must rely on other criteria in addition to vital sign criteria.



Session XVI: Quickshot Session I 1-13
Paper QS-11: 10:10 AM - 10:16 AM

OPTIMISING PREHOSPITAL TRIAGE IN AN INCLUSIVE URBAN MAJOR TRAUMA SYSTEM

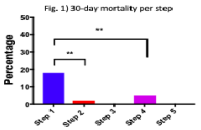
Henry O. Nnajiuba MD, MSc BSc, Elaine Cole Ph.D., Rachael Fothergill Ph.D., Mark Faulkner Gurkamal Francis Imogen Gunson Fenella Wrigley MD, Karim Brohi* MD,
Centre For Trauma Sciences, QMUL

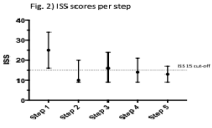
Invited Discussant: Mark Seamon, MD

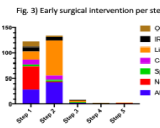
Introduction: Prehospital triage remains a crucial yet challenging component of trauma systems. The London Ambulance Service (LAS) triage tool identifies patients requiring admission to 'Level-1 equivalent' Major Trauma Centres (MTCs) or 'Level-2/3 equivalent' Trauma Units (TUs). Existing tools lack the sensitivity and specificity to consistently identify patients in need of MTC-level care. The overall objective of this study was to evaluate the relationship between individual steps on the triage tool and clinical outcomes to optimise patient flow in the system.

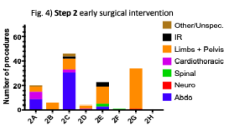
Methods: This was a one-year retrospective analysis of de-identified data matched between two trauma registries. Prehospital data including triage step activation was obtained from the LAS prehospital trauma registry for all triage-positive patients (>15 years) conveyed to an MTC within the London Major Trauma System (LMTS) in 2016. The LMTS is an inclusive regional trauma system serving over 10 million people and consists of four MTCs and 35 TUs. The LAS tool consists of Step 1 (physiology), Step 2 (anatomy), Step 3 (mechanism), Step 4 (special considerations e.g. age >55) and Step 5 (crew concern). Prehospital data was matched to corresponding demographic and outcome data obtained from the UK national trauma registry. Deterministic linkage was performed using Computer-Aided Dispatch number (CAD) as a unique identifier.

Results: From 1739 eligible triage-positive patients, 1217 (70%) were successfully matched to their corresponding prehospital registry entries. The single largest triage group was Step 2 (n=539). Step 1 (n=408) had the highest 30-day mortality (18%) (Fig. 1) and ISS scores (median 26, IQR 16-34) (Fig. 2). Early surgery (< 24hrs post admission) most frequently occurred in Step 2 (n=133)(Fig. 3). Only 12 patients triggering MTC admission on Steps 3, 4 or 5 (n= 223) underwent an urgent surgical intervention and no mortalities were recorded among Step 3 and Step 5 patients. With Step 2 being the largest group and encompassing a wide degree of anatomical injury patterns, a sub-analysis was performed. Step 2F (spinal trauma) had the highest mortality rate (8%) whilst 2A (chest injury) and 2D (open/depressed skull fracture) were the only two groups with median ISS scores >15. No 2D patients required early neurosurgery despite the suggestive injury anatomy (Fig. 4).









Conclusion: This study has demonstrated that physiological triage identifies the most severely injured patients. Anatomical triage shows differing performance between the numerous injury patterns. Triage via mechanism, patient age or EMS crew concern does not consistently identify patients warranting MTC admission. This is the first UK study to successfully link prehospital and inpatient trauma registries to analyse the impact of initial triage on the continuum of care. Work is ongoing to analyse the performance of individual anatomical triggers and to determine the optimum age cut-off for MTC triage.

Session XVI: Quickshot Session I 1-13
Paper QS-12: 10:16 AM - 10:22 AM

PERFORMANCE-BASED ASSESSMENT OF TRAUMA SYSTEMS: ESTIMATES FOR THE STATE OF OHIO

Priti P. Parikh Ph.D., Pratik Parikh Ph.D., Monit Vaishnav BS, Susan Sebastian Mary C. McCarthy* MD, Robert J. Winchell* MD, Wright State University

Invited Discussant: David Ciesla, MD

Introduction: The American College of Surgeons (ACS) has developed a Need-Based Assessment of Trauma Systems (NBATS) tool to estimate the optimal number of trauma centers (TCs) in a region, based on the population needs. While this initial version provides a foundation for quantitative evaluation of this need, it does not address TC location or corresponding system performance. In this study, we propose a performance-based assessment model to optimize the number and distribution of trauma centers in a region using undertriage (UT) and overtriage (OT) as the key metrics.
Methods: We obtained deidentified data for 2012 from the state of Ohio trauma and EMS registries that were probabilistically linked. There were 6242 complete matched records, and a network of 161 total hospitals (21 of which were LI/II TCs). We used the NBATS scoring system to evaluate the number of TCs needed in each of the 8 homeland security regions in the state (each serving as the Trauma Service Area, TSA). For the performance-based model, we used an optimization model that minimizes the number of LI/II TCs required in a given TSA for prespecified UT and/or OT. For a given trauma network, we used a notional field triage protocol to determine the destination hospital based on the injury severity and times to the nearest TC.
Results: The NBATS tool suggested fewer LI/II TCs in urban and suburban areas than existed in 2012 (12 vs. 21), while allocating at least 2 TCs to rural regions in the state that do not have a TC and are unlikely to have the resources and patient volume to support one. Both these outcomes confirm previous findings regarding the NBATS tool. As shown in Table 1, using the notional triage algorithm, the 21 LI/II centers resulted in UT=0.2 and OT=0.5. The performance-based model suggested that 10 LI/II TCs, with a slightly different geographic distribution, could emulate the same level of UT and OT. To achieve UT≤0.05 as recommended by the ACS, our model suggested a total of 21 LI/II TCs, but with significantly different geographic distribution (Figure 1). In both cases, the model suggested a less-clustered urban area and a more dispersed distribution in sub-urban and rural areas.
Conclusion: This study demonstrates an objective assessment of trauma system performance based on the threshold levels for mistriages. The model expands upon the NBATS approach, considering both TC volumes and access. Further, the geographically optimized solution may provide a useful benchmark against which to judge incremental system development or proposed changes in system structure. This type of objective data are essential to guide policy decisions.

Fig. 1: Distribution of Trauma Centers
(a) 2012 OH Trauma System and (b) Optimized OH Trauma System

Table 1: Comparison of Performance-Based Assessments

Approach	Constraints		# of TCs	UT rate	OT rate
	UT	OT			
2012 Ohio System (Fig. 1a)	-	-	21	0.2	0.5
NBATS	-	-	12	N/A	N/A
Performance-Based (per current)	≤0.2	≤0.5	10	0.18	0.40
Performance-Based (per ACS; Fig. 1b)	≤0.05	≤0.6	21	0.047	0.52

Session XVI: Quickshot Session I 1-13
Paper QS-13: 10:22 AM - 10:28 AM

Mass Casualty Preparation: Injury Patterns And Resource Utilization Of Survivors And Decedents

Chadwick P. Smith MD, Karen Safcsak RN, Heidi Emrani MD, Joseph Ibrahim MD, Michael L. Cheatham* MD, Orlando Health

Invited Discussant: David Shatz, MD

Introduction: Active shooter mass casualty events are increasing in frequency. Effective trauma center response requires advance preparation. A detailed examination of mass casualty injury patterns in both survivors and decedents will improve trauma system preparation for future events.

Methods: All patients admitted to a Level 1 trauma center following an active shooter mass casualty event were analyzed. Autopsy reports of decedents were also reviewed. Patients with minor injuries treated and discharged from the emergency department and those treated at other hospitals were excluded. Survivors were compared to decedents with respect to demographic information, bullet penetration by body region, 2015 Injury Severity Score (ISS), and AAST organ injury scales (calculated by three acute care surgeons). Data are presented as mean ± standard deviation (range). Statistical significance was determined using Mann-Whitney U and Fisher's Exact tests.

Results: There were 102 known victims of the event. 49 patients were brought to the trauma center; 5 patients were pronounced dead on arrival and 4 patients arrived in extremis and died within minutes. 29 patients were admitted. 11 patients had minor injuries and were discharged. 13 victims were taken to other hospitals. 40 victims died at the scene. There were no demographic differences between survivors (n=29) and decedents (n=49). Decedents had more bullet entry wounds [4±3 (1-13) vs. 2±1 (1-5), p=0.008]. Bullet wounds to the head were more common among the deceased [11% vs. 3% p=0.032] while bullet wounds to the abdomen were more common in survivors [25% vs. 14%, p =0.027]. ISS was significantly higher among the deceased [40±10 (9-75) vs. 16±20 (1-41), p<0.0001]. Decedents were more likely to have heart, thoracic vascular, diaphragm, liver, kidney, and stomach AAST scores while survivors were more likely to have small bowel, colon, and abdominal vascular scores. Operative procedures were divided into two phases: initial 24 hours and total hospitalization. 34 cases were performed in the first 24 hours (20 acute care surgery, 9 orthopedic surgery, 4 hand surgery, 1 vascular surgery) with a total of 87 cases during the index hospitalization (46 acute care surgery, 15 orthopedic surgery, 12 hand surgery, 10 plastic surgery, 3 vascular surgery, 1 urology).

Conclusion: Analysis of this mass casualty event demonstrates significant differences in injury patterns between survivors and decedents. Need for specialty surgeons varied according to the phase of response. Knowledge of these patterns may enable trauma centers to better prepare for active shooter events.

Session XVII: Quickshot Session II 13-26
Paper QS-14: 10:38 AM - 10:44 AM

EARLY HYPERMETABOLISM IS UNCOMMON IN TRAUMA ICU PATIENTS

Saskya Byerly MD, MS, Georgia Vasileiou MD, Sinong Qian MD, Eugenia Lee MD,MPH, Jonathon Parks MD, Michelle Mulder MD, Daniel G. Pust MD, Rishi Rattan* MD, Edward Lineen MD, Patricia Byers* MD, Nicholas Namias* MD, D. Dante Yeh* MD, University of Miami

Invited Discussant: Panna Codner, MD

Introduction:It is commonly believed that critically injured patients experience an ebb/flow metabolism shortly after insult and a "stress factor" is often applied when calculating caloric prescription. However, classic experiments demonstrating hypermetabolism after major trauma were performed decades ago in a different era of critical care. We aim to describe the post-traumatic metabolic response in trauma intensive care unit (ICU) patients in the modern era.

Methods:In this prospective, observational study from 03/18-02/19, mechanically ventilated adults (age>18 years) in the trauma ICU were included. Continuous indirect calorimetry (IC) was initiated within 48 h of ICU admission and multiple daily resting energy expenditure (REE) measurements were recorded during steady state (<5% coefficient of variation for VO_2 and VCO_2). Basal energy expenditure (BEE) was calculated by the Harris-Benedict equation. By convention, hypometabolism was defined as average daily REE<0.85* BEE and hypermetabolism defined as average daily REE>1.15* BEE. "Classic ebb/flow" was defined as initial hypometabolism followed by hypermetabolism during the first 7 ICU days. Data collected included demographics, injury characteristics, interventions, and clinical outcomes. Descriptive statistics and multivariable logistical regression models evaluating age, body mass index (BMI), weight, injury mechanism, heart rate, and temperature with the outcome variable of hypermetabolism for the first three days ("sustained hypermetabolism") were performed.

Results:Fifty-five patients were analyzed: median age was 38 [28-56] years, 38 (69%) were male, BMI was 28 [26-32] kg/m ^{2}, and ISS was 27 [19-34] with 38 (71%) blunt, 8 (15%) penetrating, and 7 (13%) burn injury mechanism. Overall, 19 (35%) had hypermetabolism on day 1 ("immediate hypermetabolism"), 11 (21%) had sustained hypermetabolism for the first 3 days, and 4 of 32 (13%) subjects with 7 days of REE data exhibited hypermetabolism for all 7 days. Classic ebb/flow metabolism was exhibited in only 1 (3%) patient. Immediate hypermetabolism patients were more likely to have a hemorrhagic complication (21% vs 3%, p=0.044), and had longer hospital (50 [29-68] vs 23 [15-53] days, p=0.031) and ICU stays (36 [22-59] vs 15 [10-36] days, p=0.019). Logistic regression analysis identified only penetrating or burn mechanism as independent predictors of sustained hypermetabolism (AOR: 2.4, 95%CI: 1.5-149.2, p=0.031).

Conclusion:In the modern era, the classic ebb/flow metabolic pattern is rare after major trauma. Only a minority of injured patients are sustained hypermetabolic in the first week after injury. Indirect calorimetry is recommended to avoid systematic overfeeding of critically ill trauma patients. Immediate hypermetabolism is associated with worse clinical outcomes.

Session XVII: Quickshot Session II 13-26
Paper QS-15: 10:44 AM - 10:50 AM

THE "DEATH DIAMOND" - A BLACK HOLE FOR RESUSCITATION

Michael S. Farrell BS,MD, MS, Julia Coleman MD, Mark Walsh MD, Scott Thomas* MD, Stefani Vandelunde MD, JD,, Thomas Marconi BS, Michael Chapman MD, Mitchell Cohen* MD, Hunter Moore MD,Ph.D., Earnest Moore* MD, Sherry Sixta* MD, Christianacare Health Services

Invited Discussant: Peter Hammer, MD

Introduction: Acute coagulopathy of trauma (ACOT) is a lethal unbalanced progression of fibrinolysis after a traumatic insult. In 2015, Chapman et al recognized an initial fibrinolytic rapid thromboelastography (rTEG) tracing designated the "Death Diamond" (DD) which was noted to have a 100% positive predictive value (PPV) for mortality in their small sample size (n=14). Recognizing the potential prognostic implications and the resource savings associated with validating the DD as a marker of futile care, we sought to evaluate it within a larger trauma population. We hypothesized that the DD would again demonstrate a 100% PPV for mortality.

Methods: A multi-center, retrospective review was completed at four American College of Surgeons designated Level 1 and 2 Trauma Centers. Trauma patients were identified by their DD tracing through institutional databases. A chart review was completed assessing: demographics, injury severity score (ISS), mechanism of injury, transfusion requirements, and discharge disposition. Statistical comparison was completed between survivors and non-survivors.

Results: A total of 52 patients displayed a DD with 49 (94%) dying during their hospital stay. There was no difference in sex (84% vs 67% male) (p=0.45), mechanism of injury (63% vs 67% blunt) (p=0.9), or ISS (33 ± 15 vs 20 ±18) (p=0.34) between the non-survivor and survivor groups, respectively. The non-survivor group was significantly older than the survivor group (46 ± 21 vs 28 ± 4 years old) ($p<0.001$). Both groups had large transfusion requirements with an overall average of 25 ± 24 units of blood product used per patient. There was no difference between survivors and non-survivors in product usage (Table 1). A total of 28 patients received repeat TEGs with 11 "normalizing" through a combination of surgical interventions and transfusions. Despite the TEG correction, only 2 survived. One survivor never demonstrated a "normal" TEG.

	Non survivors (n=49)	Survivors (n=3)	Overall (n=52)	P-Value
pRBC	14 ± 13	8 ± 5	14 ± 12	0.18
FFP	8 ± 9	7 ± 2	8 ± 9	0.58
Platelets	2 ± 3	1 ± 1	2 ± 3	0.23

Table 1. Mean use of blood products

Conclusion: The DD is a unique rTEG tracing that is highly predictive of mortality in association with a blunt traumatic mechanism. Hemostatic correction of the DD tracing infrequently leads to a meaningful survival, especially with advancing age. This collaboration further validates the DD as a predictor of futility and presents an opportunity for preservation of blood products and resuscitative resources.

Session XVII: Quickshot Session II 13-26
Paper QS-16: 10:50 AM - 10:56 AM

OUT-OF-POCKET SPENDING BY TRAUMA PATIENTS FOLLOWING IMPLEMENTATION OF THE AFFORDABLE CARE ACT

Charles Liu MD, Yusuke Tsugawa MD,MPH,Ph.D., Thomas G. Weiser* MD,MPH, David A. Spain* MD, Melinda Maggard-Gibbons MD, MSHS Stanford University

Invited Discussant: Nathan Mowery, MD

Introduction: Trauma is an expensive and potentially impoverishing driver of out-of-pocket spending for families in the US. In 2014, the Affordable Care Act (ACA) led to the expansion of Medicaid in some states and established marketplaces for individuals to purchase subsidized health insurance. We evaluated the impact of the ACA on non-elderly trauma patients' out-of-pocket spending and likelihood of incurring catastrophic health expenditures (CHE).

Methods: We identified out-of-pocket expenditures by US adults age 19-64 who had an inpatient hospital stay or ED visit for trauma using the Medical Expenditure Panel Survey, 2010-2015. CHE was defined as spending exceeding 10% of family income. Three income groups were evaluated: (1) individuals eligible for the ACA Medicaid expansions (income ≤138% Federal Poverty Level [FPL]),
(2) individuals eligible for ACA insurance subsidies (139-400% FPL), and (3) policy-ineligible individuals (>400% FPL). Changes in out-of-pocket spending were evaluated using multivariable linear regression and changes in odds of CHE using multivariable logistic regression, controlling for age, sex, race/ethnicity, marital status, country of birth, census region, employment, family income, and family size.

Results: Trauma patients eligible for the ACA Medicaid expansions (≤138% FPL) experienced a 40% decrease in out-of-pocket spending (95% CI: -58% to -15%) and a 41% decrease in odds of CHE (odds ratio 0.59, 95% CI: 0.39 to 0.91). Those eligible for ACA insurance subsidies (139-400% FPL) experienced a 25% decrease in out-of-pocket spending (95% CI: -43% to -1%) but no significant change in odds of CHE. Those in the policy-ineligible group (>400% FPL) experienced no significant change in out-of-pocket spending or odds of CHE.

Conclusion: Following ACA implementation, trauma patients in the income range targeted by Medicaid expansion experienced significantly lower likelihood of catastrophic expenditures, while those eligible for ACA insurance subsidies saw no significant change. More than 1 in 10 trauma patients in these income groups, however, continues to experience catastrophic expenditures.

Table. Out-of-pocket expenditures and likelihood of CHE among trauma patients pre/post ACA, by income category (n = 4,928; weighted n = 48,981,329) (*p < 0.05, **p < 0.01)

Income Category	**Annual Out-of-Pocket Expenditures, Pre-ACA (2015 dollars)**	**Unadjusted Pre-Post Difference**	**Adjusted Percent Difference†**	**95% CI (p-value)**
Medicaid Expansion-Eligible (≤ 138% FPL) (n = 1,833)	$836	-$172	-40%**	-58%, -15% (p = 0.004)
Marketplace Subsidy-Eligible (139-400% FPL) (n = 2,026)	$1,124	-$34	-25%*	-43%, -1% (p = 0.042)
Policy-Ineligible (> 400% FPL) (n = 1,069)	$1,246	+$62	+7%	-17%, +37% (p = 0.62)
Income Category	**Annual Likelihood of CHE, Pre-ACA**	**Unadjusted Pre-Post Difference**	**Adjusted Odds Ratio‡**	**95% CI (p-value)**
Medicaid Expansion-Eligible (≤ 138% FPL) (n = 1,833)	31.2%	-8.7%	0.59*	0.39, 0.91 (p = 0.017)
Marketplace Subsidy-Eligible (139-400% FPL) (n = 2,026)	9.2%	+0.04%	1.11	0.67, 1.84 (p = 0.69)
Policy-Ineligible (> 400% FPL) (n = 1,069)	2.5%	-1.1%	0.86	0.27, 2.77 (p = 0.80)

† Linear regression of log(x+1) transformed data, with survey weights
‡ Logistic regression, with survey weights

Session XVII: Quickshot Session II 13-26
Paper QS-17: 10:56 AM - 11:02 AM

SIX IS THE NEW FIVE: MINOR CHANGE IN INITIAL PEEP SETTING DECREASES RATES OF VENTILATOR ASSOCIATED EVENTS IN MECHANICALLY VENTILATED TRAUMA PATIENTS

Ethan A. Ferrel MD, Kristina M. Chapple Ph.D., Liviu G. Calugaru RRT, Jennifer E. Maxwell MSN, Jessica N. Johnson BSN, Andrew W. Mezher BS, James N. Bogert* MD, Jordan A. Weinberg* MD, CREIGHTON UNIVERSITY ARIZONA HEALTH EDUCATION ALLIANCE: ST JOSEPH'S HOSPITAL AND MEDICAL CENTER

Invited Discussant: Rachael Callcut, MD

Introduction:
Surveillance of ventilator-associated events (VAEs) as defined by the National Healthcare Safety Network (NHSN) is performed at many U.S. trauma centers and considered a measure of healthcare quality. The surveillance algorithm relies in part on increases in positive end-expiratory pressure (PEEP) to identify VAEs. The purpose of this study was to evaluate the effect of initiating mechanically ventilated trauma patients at marginally higher PEEP on incidence of VAEs.

Methods:
Analysis of level-1 trauma center patients mechanically ventilated 2+ days from 2017-2018 was performed after an institutional ventilation protocol increased initial PEEP setting from 5 (2017) to 6 (2018) cmH2O. Incidence of VAEs per 1000 vent days was compared between PEEP groups. Logistic regression modeling was performed to account for age, ventilator days, injury mechanism, and severity.

Results:
519 patients met study criteria (274 PEEP 5 and 245 PEEP 6). Rates of VAEs were significantly reduced among patients with initial PEEP 5 vs. 6 (16.17 per 1000 vent days vs. 7.78 per 1000 vent days; p=0.028). Logistic regression demonstrated that initial PEEP 6 was associated with 62% reduction in VAEs (odds ratio 0.38 [0.17 – 0.84] – see Table).

Conclusion:
Our data suggest that an incrementally increased baseline PEEP setting was associated with a significantly decreased incidence of VAEs in trauma patients. This minor change in practice may have a major impact on a trauma center's quality metrics.

	Odds Ratio	95% CI for Odds Ratio	P-value
Age	.99	0.97 – 1.01	.274
ISS	1.03	1.00 – 1.06	.029
Penetrating Injury	1.30	0.46 – 3.67	.619
Vented 7+ days	97.47	13.08 – 726.65	<.001
Initial PEEP 6	**0.38**	**0.17 - 0.84**	**.017**
Model AUC (95% CI)	*0.85 (0.79 -0.90)*		

Session XVII: Quickshot Session II 13-26
Paper QS-18: 11:02 AM - 11:08 AM

IDENTIFYING OBJECTIVE MEASURES FOR TRAUMA CENTER ACCESSS ASSESSMENT USING GIS-BASED TECHNOGLOGY

Suzan Dijkink MD, Robert J. Winchell* MD, Pieta Krijnen Ph.D., Inger B. Schipper MD,Ph.D., Leiden University Medical Center
Invited Discussant: Frederick Rogers, MD

Introduction: There is no generally accepted methodology to assess trauma system performance. Our aim was to illustrate how geographic information systems (GIS) technology can be used to evaluate trauma center (TC) access.
Methods: GIS-base analysis using ArcGIS-PRO was performed to assess the influence of geographical TC distribution (1, 2 or 3TCs) and traffic flow (rush[R]- and low traffic[L] hours) on the transportation time(TT) and population coverage in a densely-populated region with 3 TCs in the Netherlands (≈1.84 million inhabitants in an area of 3.403km 2) (figure 1a).
Results: In all models, 100% of the population can be transported to one of the three TC's in <60 minutes during both [R] and [L] (figure 1b). During [R], the average TT increases in all models (figure 1b). In model 1, the current situation, the average TT increases from 17 minutes during [L] to 22minutes during [R] (figure 1c.). This is roughly similar to the times reported in the regional trauma registry (23 and 25 minutes respectively). The population able to reach the closest TC in <15 and <30 minutes decreases in [R] in all 7 models (figure 1b). Transportation and coverage metrics of hypothetical models with two, geographically well-spread TCs (models 2&3) showed similar results as the current three-TC-model. One-TC-models (5-7) showed considerable increase of TTs.
Conclusion: Our GIS-based model showed good correlation with trauma registry data regarding TTs. This approach provides a way to objectively assess the accessibility of the trauma systems as well as the effect of proposed structural trauma system changes, such as TC distribution.

Figure 1a

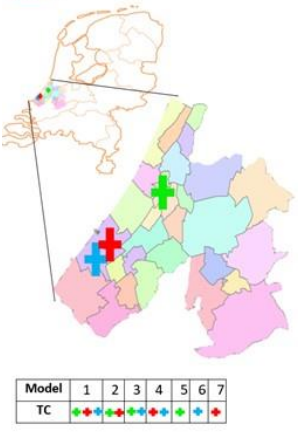


Figure 1b % population covered within 60 minutes of closest TC in rush hour (R) and low traffic hours(L) based on GIS-analysis

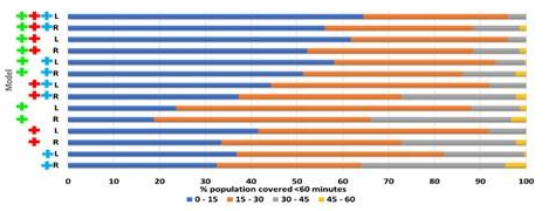
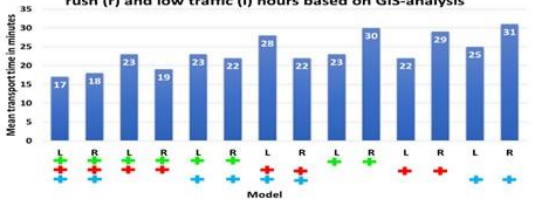


Figure 1c Mean transport time in minutes to closest TC during rush (r) and low traffic (l) hours based on GIS-analysis



Session XVII: Quickshot Session II 13-26

Paper QS-19: 11:08 AM - 11:14 AM

THE ROLE OF CRYOPRECIPITATE IN MASSIVELY TRANSFUSED PATIENTS: RESULTS FROM THE TQIP DATABASE MAY CHANGE YOUR MIND

Michael Ditillo DO, Kamil Hanna MD, Lourdes Castanon MD, Muhammad Zeeshan MD, Narong Kulvatunyou MD, Andrew Tang MD, Joseph Sakran* MD,MPH, Lynn Gries MD, Bellal Joseph* MD, Allegheny General Hospital

Invited Discussant: John Holcomb, MD

Introduction: Cryoprecipitate was developed for the treatment of inherited and acquired coagulopathies. The role of cryoprecipitate in massively transfused (MT) trauma patients is still speculative. The aim of our study was to assess the role of cryoprecipitate as an adjunct to MT in trauma patients.

Methods: We performed a 2-year (2015-2016) analysis of the ACS-TQIP dataset and included all adult trauma patients who received MT (>10pRBCs/24-hour). Patients were stratified into two groups based on receipt of cryoprecipitate within the first 24-hours (Cryoprecipitate vs. No-Cryoprecipitate). Outcome measures were blood products transfused, in-hospital complications, and mortality. Multivariate logistic and linear regression analyses were performed.

Results: We analyzed a total of 593,818 trauma patients, of which 7,556 (Cryoprecipitate: 3,468; No-Cryoprecipitate: 4,088) were included in our analysis. Mean age was 40±20y, median ISS was 31[22-42], and GCS was 8 [3-15]. Overall volume of pRBCs transfused in the first 24-hours was 16[12-24] units, plasma was 11[7-17] units, and the platelet was 3 [1-4] units. The overall complication rate was 35%, mortality was 37%, and 25% of the patients died in the first 24 hours. Patients in the cryoprecipitate group received a lower volume of plasma (p<0.01), and pRBCs (p<0.01). Additionally, patients who received cryoprecipitate had lower rates of 24-hrs mortality (p<0.01) and in-hospital mortality (*p<0.01*). However, there was no difference between the two groups regarding complications (*p=0.28*), or volume of platelet transfused (p=0.19) (**Table 1**). On multivariate logistic regression, the use of cryoprecipitate as an adjunct to MT was associated with decreased 24-hrs mortality (OR: 0.82[0.74-0.91], *p=0.02*), in-hospital mortality (OR: 0.88[0.79-0.94], *p=0.03*), but had no association with in-hospital complications (OR: 1.22[0.94-2.04], *p=0.58*). On linear regression, the use of cryoprecipitate was not associated with 24-hr pRBCs (β= -0.10[-0.34 to 0.25], *p=0.41*), 24-hr plasma (β= -0.09[-0.28 to 0.31], *p=0.36*), and 24-hr platelets transfusions (β= -0.14[-0.28 to 0.16], *p=0.16*).

Conclusion: The use of cryoprecipitate as an adjunct to MT may reduce mortality without affecting in-hospital complications and transfusion requirements. Further studies are needed to better understand its potentially beneficial effects in massively transfused patients.

Outcome	Cryoprecipitate (n=3,468)	No-Cryoprecipitate (n=4,088)	*P* value
24-hrs Transfusion, units, median [IQR]			
pRBCS	14 [11-19]	20 [14-31]	<0.01
Plasma	8 [5-13]	14 [9-23]	<0.01
Platelets	3[1-3]	3[1-4]	0.19
In-hospital complications, %	36%	35%	0.28
24hrs mortality, %	22.3%	27.3%	<0.01
In-hospital mortality, %	32%	41%	*<0.01*

pRBCS: packed red blood cells

Session XVII: Quickshot Session II 13-26

Paper QS-20: 11:14 AM - 11:20 AM

SAFETY AND FEASIBILITY OF ERECTOR SPINAE PLANE BLOCKS IN PATIENTS WITH CHEST WALL TRAUMA ON HIGH DOSE ENOXAPARIN

Linda A. Dultz MD,MPH, Jennifer L. Grant MD, Ryan P. Dumas MD, Thomas H. Shoultz MD, Caroline Park MD, Stephen S. Luk* MD, John C. Alexander MD, Irina Gasanova MD, Joseph Minei* MBA,MD, Michael W. Cripps* MD, MS UTSW Parkland Hospital

Invited Discussant: Ronald Gross, MD

Introduction: Multi-modal pain regimens for complex chest wall trauma often contain diametrically opposed recommendations. Current guidelines for severe rib fractures recommend neuraxial blockade in addition to multi-modal pain therapies. While the guidelines for venous thromboembolism prevention recommend chemoprophylaxis, these medications must be held for neuraxial blockade placement. Erector spinae plane block (ESPB) is a newly described neuraxial block used primarily for thoracic pain control. It is more appealing than its traditional counterparts due to its technical ease, quick learning curve and potential for less bleeding complications. We sought to describe the use of ESPB for rib fractures in patients on a high dose enoxaparin (HDE) protocol. We hypothesize that ESPB is safe and feasible in this patient population.

Methods: Retrospective observational cohort study of a single level 1 trauma center from September 2016-December 2018. All trauma patients with rib fractures undergoing ESPB were included. Demographics, chemoprophylaxis and anticoagulation regimens, outcomes and complications were collected. Our institution's HDE trauma protocol is 40mg twice daily.

Results: Patients undergoing ESPB tended to be severely injured males with more than 4 unilateral broken ribs (Table 1). Most patients (87%) received chemoprophylaxis medication without missing a dose. Nineteen patients were on a HDE protocol during their admission and 3 patients were on a full dose oral anticoagulant for other reasons. For those on HDE, 16 (84%) were able to adhere to the protocol without missing a dose while the ESPB was performed. For the three on oral anticoagulation, two were able to continue their regimen. There were zero bleeding complications from ESPB and 2 documented VTEs.

Characteristics of Patients Undergoing ESPB	n=25
Male	18 (72%)
Age	53 [36-63]
Flail chest	10 (40%)
>4 unilateral rib fractures	23 (92%)
ISS	17 [13-21]
Chest AIS	3[3-3]
LOS	10[7-12]
Chemoprophylaxis administered	23 (87%)
High-dose chemoprophylaxis administered	19 (76%)
Venous thromboembolism	2 (8%)
Bleeding complications	0 (0%)

Table 1 - Characteristics of patients undergoing ESPB. Categorical variables represented as n %. Continuous variables represented as median and interquartile ranges.

Conclusion: ESPBs can be safely and effectively placed in patients on high dose enoxaparin. This block should be considered over traditional blocks in patients with blunt chest wall trauma due to its technical ease and ability to be done with HDE.

Session XVII: Quickshot Session II 13-26

Paper QS-21: 11:20 AM - 11:26 AM

TIME TO TRACHEOSTOMY IMPACTS OVERALL OUTCOMES IN PATIENTS WITH CERVICAL SPINAL CORD INJURY (CSCI)

Tanya Anand MD, Kamil Hanna MD, Narong Kulvatunyou MD, Muhammad Zeeshan MD, Michael Ditillo DO, Lourdes Castanon MD, Andrew Tang MD, Ashley Northcutt MD, Bellal Joseph* MD, University of Arizona - Tucson

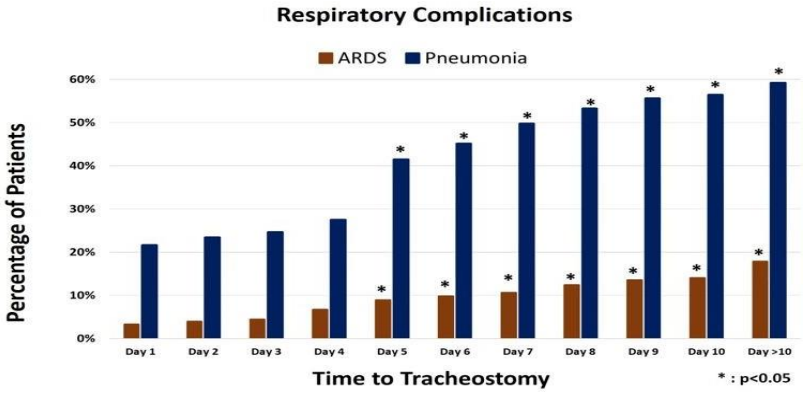
Invited Discussant: Murray Cohen, MD

Introduction: The morbidity associated with cervical spine injury increases in the setting of concomitant cervical spinal cord injury (CSCI). A significant proportion of these patients require placement of a tracheostomy. However, it remains unclear if timing to tracheostomy following traumatic CSCI can impact outcomes. The aim of our study was to characterize outcomes associated with tracheostomy timing following traumatic CSCI.

Methods: We performed a 5-year (2010-2014) analysis of the ACS-TQIP database and included all adult (Age³18y) trauma patients who had traumatic CSCI and received tracheostomy. Patients were subdivided into two-groups: early-tracheostomy (ET: ≤4 days from initial intubation) and late-tracheostomy (LT: >4 days). Outcome measures included respiratory complications, ventilator days, ICU and hospital length of stay, and mortality. Multivariate logistic regression analysis was performed.

Results: A total of 5,980 patients were included in the study, of which 1,010 (17%) patients received ET while 4,970 (83%) patients received LT. Mean age was 46-years,and 73% were males. In terms of CSCI location, 48% of the patients had high CSCI (C1-C4) while 52% had low CSCI (C5-C7). Patients in the ET group had lower rates of respiratory complications (27% vs 59%, *p=0.01*), fewer ventilator days (11d vs 19d, *p=0.01*), shorter ICU (12d vs 21d, *p=0.01*) and hospital length of stay (20d vs 28d, *p=0.01*) compared to those in the LT group. On regression analysis, ET was associated with lower rates of respiratory complications in patients with high CSCI (OR: 0.49[0.36-0.71]) and low CSCI (OR: 0.82[0.61-0.93]). However, no association was found between time to tracheostomy and in-hospital mortality.

Conclusion: ET regardless of CSCI level may lead to improved outcomes. Quality improvement efforts should focus on defining the optimal time to tracheostomy and considering ET as a component of SCI management bundle.



Session XVII: Quickshot Session II 13-26

Paper QS-22: 11:26 AM - 11:32 AM

AAST GRADING SCALE FOR ACUTE MESENTERIC ISCHEMIA ACCURATELY PREDICTS MORBIDITY AND MORTALITY: A VALIDATING RETROSPECTIVE COHORT STUDY

Jake Forman DO, Bethany Clutts MD, James Dove BA, Marcus Fluck BS, Jeffrey Wild MD, Denise Torres MD, Kenneth Widom MD, Geisinger Health System

Invited Discussant: Shahid Shafi, MD, MPH, MBA

Introduction: Emergency general surgery (EGS) cases historically have higher morbidity and mortality compared to elective surgeries. The American Association for the Surgery of Trauma (AAST) recently developed grading systems for the most common EGS diagnoses to help delineate peri-operative risk stratification as well as morbidity and mortality based on previous literature and expert opinion. However, the grading scales have not been externally validated to determine associated outcomes. This study externally validates the AAST grading scale for acute mesenteric ischemia (AMI).

Methods: A retrospective, single institution, multi-hospital cohort study with review of electronic medical records between 1/1/2008 and 8/2/2018 was performed. All patients within the aforementioned time frame with AMI were stratified by grade according to the AAST grading scale using clinical, imaging, operative and pathologic criteria.

Results: A total of 378 patients were reviewed with 132 meeting inclusion criteria. Patients were placed into five categories based on AAST grade. The majority of patients fell within grade 2 (44%; N=58) followed by grade 3 (26%; N=34), grade 4 (22%; N=29), grade 1 (7%; N=9) and lastly grade 5 (2%; N=2). There was a stepwise progression in 30 day and 1-year mortality based on increasing AAST grade.

Our data supports a statistically significant correlation between increasing AAST grades and 30-day mortality ($P = 0.010$). The calculated correlation coefficient based on a logistic regression model for 30-day mortality is 0.65, indicating predictability of increasing mortality with increasing grades. Predicted probability of 30-day mortality based on increasing grades were 10% for Grade 1 (95% CI: 4%-22%), 16% for Grade 2 (95% CI: 10%-26%), 26% for Grade 3 (95% CI: 18%-34%), 38% for Grade 4 (95% CI: 25%-53%) and 52% for Grade 5 (95% CI: 29%-75%).

The data also reveals significant correlation between increasing AAST grades and 1-year mortality ($P = 0.018$). Again, using a logistic regression model for 1-year mortality, increasing AAST grades predict increasing mortality with a correlation coefficient of 0.623. Predicted probability of 1-year mortality based on increasing grades were 18% for Grade 1 (95% CI: 9%-33%), 26% for Grade 2 (95% CI: 18%-36%), 36% for Grade 3 (95% CI: 28%-45%), 48% for Grade 4 (95% CI: 33%-63%) and 60% for Grade 5 (95% CI: 36%-79%).

Conclusion: A retrospective validation study confirms patients with higher grades on the AAST scale for AMI accurately predict higher levels of 30 day and 1-year mortality. The AAST grading scale for AMI can be used as a tool for guiding both goals of care discussions pre and post operatively as well as paint an accurate picture of short and long-term life expectancies based on clinical, imaging, operative and pathologic findings.

Session XVII: Quickshot Session II 13-26
Paper QS-23: 11:32 AM - 11:38 AM

OBESITY AND IMPAIRED VASCULAR BARRIER FUNCTION AFTER SHOCK: A BIOMETIC IN VITRO MODEL USING MICROFLUIDICS

Lawrence N. Diebel* MD, David Liberati MS
Wayne State University

Invited Discussant: Susan Evans, MD

Introduction: Obesity is associated with poorer outcomes following severe trauma and include an increase incidence of acute kidney injury, respiratory failure and ARDS as well as multiple organ failure. It has been shown that the endotheliopathy of trauma is an early phenomenon and is associated with the development of these complications. Adiponectin is a adipokine important in maintaining vascular homeostasis. Its levels are decreased in obesity and associated comorbidities. We therefore hypothesized that plasma from obese vs. non-obese patients would have different effects on the glycocalyx and endothelial vascular barrier after trauma/hemorrhagic shock (T/HS). This was studied in a*in vitro* model.
Methods: Human umbilical vein endothelial cell (HUVEC) monolayers established in microfluidic devices were exposed to hypoxia (1% O2) and epinephrine perfusion conditions (90 minutes) followed by the addition of 5% plasma from obese or non-obese patients. Endothelial glycocalyx (EG) integrity was indexed by thickness using fluorescent microscopy and shedding of syndecan-1 (syn-1) and hyaluronic acid (HLA) EG components. Endothelial cellular injury/activation was indexed by soluble thrombomodulin (sTM). The adipokines adiponectin and leptin were measured in the plasma samples used for the experiments.
Results: Mean ± SD (N = 8 for each group)
Adiponectin concentrations were 45.1 ± 4.3 vs. 24.9 ± 2.1 and leptin concentrations were 19.2 ± 2.2 vs. 38.7 ± 3.6 in non-obese vs. obese individuals respectively (P<0.05).
Conclusion: There was no effect of plasma from either nonobese or obese patients on the glycocalyx or endothelium in experiments conducted under control flow conditions. However, plasma from obese patients failed to protect the glycocalyx and endothelial vascular barrier from injury after exposure to biometic conditions of T/HS. This was related to significant differences in adiponectin and leptin concentrations in obese vs. non-obese individuals and may be a potential target for therapeutic interventions.

	HLA (ng/ml)	Syndecan (ng/ml)	HUVEC glycocalyx thickness (Fluor intensity)	TM (pg/ml)
HUVEC control (ON flow)	14.8 ± 1.5	27.5 ± 2.4	265.3 ± 19.6	27.8 ± 1.2
HUVEC + normal plasma	16.1 ± 1.6	27.2 ± 2.8	266.1 ± 18.2	28.1 ± 1.6
HUVEC + obese plasma	20.2 ± 2.6	29.2 ± 2.8	260.5 ± 17.9	31.1 ± 2.5
HUVEC + Hyp + Epi	98.4 ± 8.2*	100.5 ± 10.2*	143.4 ± 18.5*	106.5 ± 12.3*
Hypoxia + Epi + normal plasma	18.6 ± 2.3	31.6 ± 4.4	249.8 ± 15.9	33.6 ± 3.5
Hypoxia + Epi + obese plasma	51.3 ± 7.1*#	69.2 ± 6.3*#	121.2 ± 17.6*#	70.6 ± 10.6*#

*p<0.05 vs. HUVEC control, #p<0.05 vs. all other groups

Adiponectin concentrations were 45.1 ± 4.3 vs. 24.9 ± 2.1 and leptin concentrations were 19.2 ± 2.2 vs. 38.7 ± 3.6 in non-obese vs. obese individuals respectively (P<0.05).

Session XVII: Quickshot Session II 13-26

Paper QS-24: 11:38 AM - 11:44 AM

REGIONALIZATION OF EMERGENCY GENERAL SURGERY OPERATIONS: A SIMULATION STUDY

Robert D. Becher MD, MS, Nitin Sukumar MS, Michael P. DeWane MD, Thomas M. Gill MD, Adrian A. Maung* MD, Kevin M. Schuster* MD,MPH, Marilyn J. Stolar Ph.D., Kimberly A. Davis* MBA,MD, Yale School of Medicine

Invited Discussant: Nancy Parks, MD

Introduction: It has been theorized that a tiered, regionalized system of care for emergency general surgery (EGS) patients – akin to regional trauma systems – would translate into significant survival benefits. Yet data to support this are lacking. The aim of this study was to determine the potential number of lives that could be saved by regionalizing EGS care to higher-volume, lower-mortality EGS institutions.

Methods: Adult patients who underwent one of ten common EGS operations were identified in the California Inpatient Database (2010-2011). An algorithm was constructed that "closed" lower-volume, higher-mortality hospitals and referred those patients to the remaining higher-volume, lower-mortality institutions ("closure" based on hospital EGS volume-threshold that optimized to 95% probability of survival, by operation). Primary outcome was the potential number of lives saved per operation, aggregated across hospitals. Regionalization-simulations were completed 5000 times for each operation employing a bootstrap resampling method to proportionally redistribute patients. Estimates of expected deaths at the higher-volume hospitals were recalculated for every bootstrapped sample.

Results: Of the 165,123 patients who underwent EGS operations over the 2 years, a total of 17,655 (10.7%) were regionalized to a higher-volume hospital. On average, 25% of lower-volume hospitals were "closed," though it varied by operation (from 3.9% closures for cholecystectomy to 57.7% for repair perforated peptic ulcers). The simulations demonstrated that EGS regionalization would prevent 9.7% (586) of total risk-adjusted EGS deaths and significantly save lives for every EGS operation (from 4.7% of lives saved for cholecystectomy to 22.2% for umbilical hernia repair). On average, regionalization prevented 4.6 deaths per 100 EGS patient-transfers (ranging from 1.3 for appendectomy to 8.0 for umbilical hernia repair).

Conclusion: This simulation study provides important new insight into the concept of EGS regionalization, suggesting that 1 in 10 risk-adjusted deaths could be prevented by a structured system of EGS care. Future work should expand upon these findings using discrete-event simulation models to compare triage criteria, incorporate hospital resources and time to definitive care, and study the impact on access to care for resource-limited populations.

Session XVII: Quickshot Session II 13-26

Paper QS-25: 11:44 AM - 11:50 AM

COMMON SENSE CAN REDUCE AFRICAN AMERICAN HOMICIDE RATES: THE EFFECT OF UNIVERSAL BACKGROUND CHECKS

Elinore J. Kaufman MD, MS, Christopher N. Morrison Ph.D., Erik Olson MD, David Humphreys Ph.D., Douglas J. Wiebe Ph.D., Niels D. Martin* MD, Carrie A. Sims* MD,Ph.D., Mark Hoofnagle MD,Ph.D., Charles W. Schwab* MD, Patrick Reilly* MD, Mark J. Seamon* MD, University of Pennsylvania

Invited Discussant: Tracey Dechert, MD

Introduction: In 2017, 14,542 Americans died from firearm homicide. Federal law requires background checks for firearms purchased from licensed dealers only. As of 2017, 19 states extended this requirement to gun show and private handgun sales (UBC-HG). Although firearm homicide disproportionately affects African American (AA) populations, little is known about how UBG-HG legislation impacts AAs. We hypothesized that UBC-HG would not impact AA firearm homicide rates.
Methods: We collected Centers for Disease Control firearm homicide counts for AA and white populations in the 50 states, 1999-2017. Laws were collected from the State Firearm Laws Database. The exposure of interest was UBC-HG adoption and the outcome was firearm homicide. We used Poisson regression to perform a differences-in-differences analysis. State fixed effects accounted for time-invariant state characteristics while a categorical variable for year accounted for trends over time. We also controlled for state-specific, time-variable factors: median household income, population <25 or ≥65 years, per capita alcohol consumption, and total count of firearm laws (UBC excluded). Standard errors were clustered by state.
Results: The overall firearm homicide rate among whites was 1.6 per 100,000 (Interquartile Range [IQR] 0.9-2.6) with a low of 1.4 in 2011 and a high of 1.8 in 2016. The firearm homicide rate was 12.3 per 100,000 (IQR 7.5-18.2) among AAs, with a low of 10.6 in 2011 and a high of 15.6 in 2016. There was no significant difference in firearm homicides among whites (Incidence rate ratio [IRR] 0.93, 95% CI 0.73, 1.18), but passage of UBC-HG was associated with an 18% decrease in AA firearm homicides (IRR 0.82, 95% CI 0.70, 0.96; p=0.012). These results were consistent across gender (Table). National UBC-HG application could have saved 23,947 (95% CI 5587, 44,306) lives during the study period.

Conclusion: Implementing UBC-HG was associated with decreased firearm homicides among AA males and females—the population most at risk. Expanding UBC-HG may be an effective approach to reducing racial disparities in American firearm homicides.

Session XVII: Quickshot Session II 13-26
Paper QS-26: 11:50 AM - 11:56 AM

COMPARISON OF A TRAUMA COMORBIDITY INDEX WITH OTHER MEASURES OF COMORBIDITIES TO PREDICT MORTALITY FOLLOWING TRAUMA

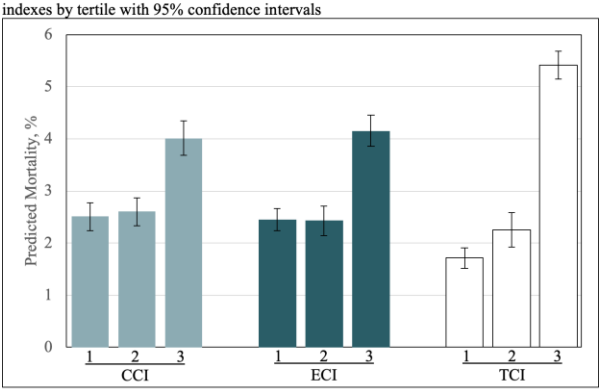
Peter Jenkins MD, Brian Dixon Ph.D., Stephanie Savage* MD, Aaron Carroll MD, Craig Newgard MD, Christopher Tignanelli MD, Mark Hemmila* MD, Lava Timsina Ph.D., Indiana Univesity School of Medicine

Invited Discussant: Alan Guo, MD, PhD

Background Comorbidities influence outcomes of injured patients, and that influence is likely to grow as the population ages. Yet a lack of consensus exists regarding how best to quantify comorbidities associated with risk of mortality. In this study, we develop and validate a trauma comorbidity index (TCI), a measure of mortality risk attributable to comorbidities, designed for use specifically with trauma registry data, and we compare the association of the TCI and other existing measures of comorbidities with mortality.

Methods The study used state trauma registry data (2013-2015) to train and test the TCI. The main outcome of interest was in-hospital mortality. We selected comorbidities based on a minimum threshold p-value in bivariate analysis. We then used coefficients derived from multivariable logistic regression to calculate the TCI in a "training" cohort, and we tested internal validity of the TCI with a "testing" cohort. Finally, we used adjusted models to generate areas under receiver operator characteristic curves (AUC) to compare alternative comorbidity measures, and we compared the parsimony of the models with Akaike information criterion and Bayesian information criterion.

Comparison of predicted mortality by trauma, Charlson, and Elixhauser comorbidity indexes by tertile with 95% confidence intervals



CCI – Charlson comorbidity index
ECI – Elixhauser comorbidity index
TCI – Trauma comorbidity index

Results Of 85,351 patients admitted to 111 hospitals, 73% had at least one comorbidity. The TCI was significantly associated with mortality, and two-fold internal cross-validation confirmed that association. All comorbidity measures increased the AUC significantly above a baseline value (0.91). The TCI demonstrated a combination of the greatest AUC (0.92) and model parsimony.

Conclusion The prevalence of comorbidities was substantial, and they were significantly associated with mortality. The TCI demonstrated superior model discrimination compared with other measures of comorbidities.