Poster # 1

ANASTOMOTIC LEAKS IN TRAUMA VS EMERGENCY GENERAL SURGERY: WHAT MAKES A DIFFERENCE?

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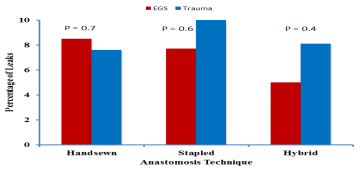
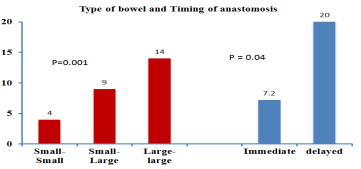
Introduction: Anastomotic leak is one of the surgeons' greatest fears following a bowel resection. Many peri-operative risk factors have been evaluated, but it is unclear if operations done acutely in trauma patients and for emergency general surgery (EGS) patients have different leak rates. Our hypothesis was that differences exist in anastomotic leak rates between EGS and trauma patients, and that peri-operative risk factors can be identified.

Methods: A 7 year retrospective analysis of all trauma and EGS patients admitted to a Level 1 trauma center was performed. We included all patients who underwent a bowel resection with primary anastomosis. Patients who died within 48 hours of operation or who presented with enterocutaneous fistula were excluded. Our primary outcome measure was differences in leak rates by type of patient (trauma vs EGS). Secondary outcomes included type of anastomosis, timing of anastomosis, and operating surgeon. Anastomosis type was defined as handsewn vs stapled vs hybrid (combination of both) and timing was defined as immediate and delayed (performed after initially leaving bowel in discontinuity).

Results: A total of 520 bowel resections with primary anastomosis were identified. The overall leak rate was 7.6% (40/520). There was no difference between leak rates in Trauma and EGS patients (8.3% vs 7.2%, P=0.7). There was also no difference in leak rates when stratified by operative technique; stapled (10% vs 7.6%, p=0.6), hybrid (8% vs 5%, p=0.3), handsewn (7.6% vs 8.5%, p=0.7) (**Fig. 1**); or orientation of anastomosis: end-end (p=0.40), end-side (p=0.9), side-side (p=0.1). The leak rate by operating surgeon varied widely from 0% to 24%, however this was not statistically significant (p=0.2), nor did this correlate with surgeon experience. Large bowel anastomoses (p=0.001) and delayed anastomoses (p=0.04) were more likely to leak. (**Fig. 2**).

Conclusion: There was no difference between trauma and EGS patients with regards to leak rates after bowel anastomosis. Type of anastomosis, individual surgeon, and surgeon experience did not affect the leak rates. Colocolonic anastomoses and delaying anastomosis till another operation were the only risk factors predictive of increased leak rates. Performing anastomosis at the first operation was associated with reduced leak rates and further analysis is required to determine if delaying anastomosis is a safe alternative.





Poster # 2

CT SCAN TRUMPS PHYSICAL EXAM? AN ANALYSIS OF 1000 ABDOMINAL CT SCANS FOR BLUNT TRAUMA

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Introduction:Indications for abdominal CT scan in blunt trauma patients are not clearly defined thus resulting in a wide discrepancy of practice across institutions. Minimizing CT imaging could potentially decrease radiation burden and hospital cost. The safety of omitting an abdominal CT scan in the stable, evaluable blunt trauma patient remains uncertain.

Methods:Patients admitted with blunt trauma that underwent CT AP (abdomen, pelvis) from 6/2013 – 12/2013 were analyzed. Demographic and admission data, imaging results, and laboratory data were collected. Physical exam findings including hematoma or wound location were analyzed. Injuries on CT scan that did not correlate with examination findings were defined as occult injuries. Pelvic fractures were not considered occult injuries given variability in pre-CT scan imaging practice. Outcomes included presence of occult injury, operative or clinical intervention, and hospital LOS.

Results:During the study period, 1000 patients with CT AP for blunt trauma were identified. Overall, 172 patients had injury identified on abdominal CT with 23 classified as occult injury. In this population, 43 abdominal CT scans were performed to detect each occult injury. The sensitivity and specificity of the pre-CT scan examination for detecting abdominal injury was 86.6% and 65.2%, respectively. In stable, evaluable patients (GCS 15, SBP>90, age >13, n=590), occult abdominal injuries were identified in 11 patients (1.9%), including five patients with grade II or III solid organ injuries, two patients with grade I injury, two with mesenteric hematoma, and one patient each with signs concerning for bowel injury and hemoperitoneum. One patient underwent non-therapeutic exploratory laparotomy and one had pelvic embolization for associated pelvic fracture. Of the 11 patients with occult injury, nine presented with rapid deceleration injury. In stable, evaluable patients, 54 CT scans were performed to identify each occult injury and the sensitivity and specificity of the pre-CT examination was 89.4% and 59.5%, respectively.

Conclusion:The initial trauma assessment, even in the stable, evaluable patient, is insufficient to reliably rule out intra-abdominal injury. Although significant radiation exposure is incurred, a small percentage of solid organ injuries will be missed without liberal use of abdominal CT scan. A more reliable screening technique is needed to identify in which patients abdominal CT can be omitted after blunt trauma.

Poster # 3

A MYTH BUSTERS CASE: SHORTER OR TIMES ARE OF THE ESSENCE IN DAMAGE CONTOL LAPAROTOMY

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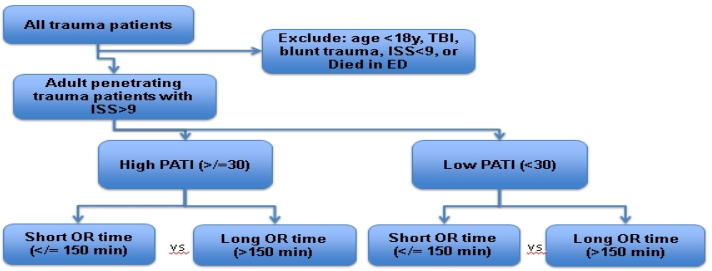
Introduction: Damage Control Laparotomy (DCL) management for severe penetrating abdominal trauma has traditionally included limiting time spent in the Operating Room (OR) to only the time necessary to control hemorrhage and contamination with normalization of physiologic derangements subsequently in the ICU. However, there is very little evidence to show survival benefits with short OR times for DCL. We hypothesize that in patients managed with DCL, longer OR times provides for more effective resuscitation than in patients with shorter OR times.

Methods: A 5-year retrospective review was conducted for all patients who underwent DCL for penetrating abdominal trauma. Patients who were under 18 years of age, who died in the OR and who sustained blunt trauma or traumatic brain injury were excluded. Penetrating abdominal trauma index (PATI) scores were calculated and patients were divided into two groups based on severity of injury: High PATI >/= 30 and Low PATI <30. OR times were analyzed for their impact on outcomes (Short OR time <150 minutes and Long OR >/=150 minutes). Outcomes measured were pre- and post-op shock index (SI), base deficit (BD), INR, and core body temperature, as well as hospital length of stay (HLOS) and mortality

Results: A total of 124 patients met inclusion criteria. Of these, 34 were excluded due to missing data. The High PATI group included 49 patients and Low PATI group included 41 patients. Although there were no differences within the High PATI group in regards to pre-op BD, SI, or body temperature the pre-op INR was significantly higher in the Long OR time when compared to Short OR time (1.3 vs 1.1, p=0.03). There was no difference in mortality, HLOS, post-op SI, or body temperature between the Long and Short OR time groups. The Long OR time patients had significantly lower post-op BD than the Short OR time patients (-3.4 vs -8.8, p = 0.001). In the Low PATI group, there were no significant differences in pre-op values or outcomes between the Long and Short OR groups.

Conclusion: In patients with penetrating abdominal trauma undergoing DCL, a shorter OR time was not associated with improved short-term resuscitation endpoints or long-term outcomes, including hospital LOS and mortality. In severely injured patients, effective resuscitation with longer OR times was not inferior to shorter OR times as evidenced by the improved acid-base status in this group. Damage control practices should focus on early surgical hemorrhage control in combination with effective intra-op resuscitation efforts and not on the amount of time it takes to accomplish these goals.



Poster # 4

THE DIAGNOSTIC YIELD OF COMMONLY USED INVESTIGATIONS IN PELVIC GUNSHOT WOUNDS

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Introduction: Patients who sustain pelvic gunshot wounds (GSWs) are at significant risk for injury due to the high density of visceral structures within the bony pelvis. Currently, the optimal work-up for pelvic GSWs is unclear. The aim of this study was to determine the diagnostic yield of tests commonly used in the investigation of pelvic GSWs.

Methods: After obtaining Institutional Review Board approval, all patients ≥ 15 years old (01/2008 – 01/2015) who sustained one or more GSWs that placed the pelvic contents at risk for injury were retrospectively identified. Patients who expired in the emergency department, were pregnant, or were transferred from an outside hospital were excluded. Patient demographics, clinical assessment, investigations, operative procedures, and outcomes were abstracted. The diagnostic yield of CT scan, cystogram, angiography, endoscopy (anoscopy and proctosigmoidoscopy), digital rectal exam (DRE), and urinalysis for clinically significant injuries to the pelvic contents was calculated.

Results: Of 1917 patients presenting with GSWs during the study period, 361 (18.8%) were at risk for pelvic injury and included in the analysis, with mean age 27.0 ± 10.4 years (15-73 years), 95.3% male, and mean ISS 12.8 ± 10.4 (1-50). Of these patients, 170 (47.1%) sustained a clinically significant pelvic injury. Patients with peritonitis, hemodynamic instability, evisceration, or who were unevaluable (n=135, 37.4%) were taken directly to the operating room for laparotomy. The remaining 226 patients (62.6%) underwent CT scan and further investigations. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of CT scan for pelvic injury were 0.82, 0.97, 0.71, and 0.99. Angiography had a sensitivity, specificity, PPV, and NPV of 1.00 in detecting pelvic vascular injuries. For bladder injuries, gross hematuria alone had a sensitivity, specificity, PPV, and NPV of 0.86, 0.98, 0.75, and 0.99. Microscopic or gross hematuria had a sensitivity, specificity, PPV, and NPV of 1.00, 0.65, 0.20, and 1.00. Cystogram had a sensitivity, specificity, PPV, and NPV of 0.75, 1.00, 1.00, and 0.91. For the detection of rectal injuries, DRE had a sensitivity, specificity, PPV, and NPV of 0.58, 0.98, 0.58, and 0.98, while the values for endoscopy were 0.82, 0.88, 0.75, and 0.92.

Conclusion: Pelvic gunshot wounds result in a high rate of clinically significant injuries to the small bowel, pelvic vasculature, sigmoid colon, bladder, and rectum. Patients who do not require emergent operation should undergo CT scan as the first diagnostic imaging test, as CT scan assesses for all pelvic injuries with a single imaging modality with high sensitivity and specificity. If CT scan is positive for a pelvic injury requiring operative management, the patient should be taken directly to the operating room without further investigations. If CT scan is negative, no additional imaging is necessary to rule out injury and the patient should be admitted for a period of observation. If CT scan is equivocal for vascular or rectal injury, patients should undergo angiography or endoscopy, respectively, as these tests are highly specific and well suited for confirmatory testing. If CT scan is equivocal for bladder injury, the patient should be examined for macroscopic hematuria. If absent, the patient does not require cystogram to rule out bladder injury. If present, the patient should undergo cystogram. Microscopic hematuria and digital rectal exam, in turn, have low positive predictive values for bladder and rectal injuries. Therefore, they should not be used to screen patients for pelvic injury after gunshot wounds.

Poster # 5

A COMPARATIVE STUDY OF LAPAROTOMY VERSUS TRANSARTERIAL EMBOLIZATION FOR SPLENIC INJURY ON MODERATE TO SEVERE TRAUMATIC BRAIN INJURY: A PROPENSITY SCORE-MATCHED ANALYSIS

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Introduction:
Splenectomy has been recommended for splenic injury of patients with moderate to severe traumatic brain injury (TBI). However, the effect of trans-arterial embolization (TAE) has not been studied in patients with TBI. The purpose of this study was to compare the outcomes of laparotomy to those of TAE.

Methods:
We used the complete datasets from the Japan Trauma Data Bank (JTDB) 2004-2014. Our analyses included the blunt trauma patients with head injuries of abbreviated injury scale (AIS) severity score of 3 or more who underwent laparotomy or TAE for splenic injury contributing the maximum AIS on abdomen. The patients under 15 y/o were excluded in this study. Comparisons between the laparotomy group (LP) and TAE group (TAE) were performed using unmatched and propensity score (PS) matched analyses. The following outcomes were compared: the survival on discharge, the survival on 30 days, length of stay and the patients' demographic data.

Results:
In unmatched analysis, the survival rates on discharge (30days) were 54.9% (55.9%) in LP (n=102) and 78.9% (76.8%) in TAE (n=95), respectively. From each group, 70 patients were extracted by the matching of PS. In the matched comparison, the survival rate on 30days in LP was lower than that of TAE (57.1% vs 78.6%, p=0.006). The survival rates on discharge were 55.7% in LP and 75.7% in TAE (p=0.012). The two matched groups did not differ in the median length of stay, the mean age and the median injury severity score (ISS).

Conclusion:
This study suggested that the TAE might be an alternative therapeutic option for splenic injury on TBI. Further investigation needs regarding the functional and neurological outcomes on TBI with splenic injury.

Propensity matched analysis

	Laparotomy	TAE	p
	n=70	n=70	
Age (year,mean)	44	44	
Female (n, %)	23 (32.8%)	21 (30.0%)	
Injury Severity Score (median, IQR)	39.5 (34-50)	41 (33.75-50)	
GCS≦8 (n, %)	32(45.7%)	29(45.7%)	
Systolic Blood Pressure ≦90mmHg (n,%)	48(68.6%)	49(70.0%)	
Length of Stay (median,IQR)	22 (2-46)	36.5 (12-55.5)	
Survival rate on Hosp.Day30 (n,%)	40(57.1%)	55(78.6%)	**0.006**
Survival on Discharge (n,%)	39(55.7%)	53(75.7%)	**0.012**

Poster # 6

SEAT BELT SIGN ON COMPUTED TOMOGRAPHY IS ASSOCIATED WITH INTRA-ABDOMINAL ORGAN INJURY IN HEAD-ON COLLISION

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Introduction: Intra-abdominal injury in association with seat belt wearing is well known, but a direct causal relation and whether the trace of the seat belt is associated with specific injuries are difficult to prove. In this study, we aimed to clarify the relationship between the seat belt sign on computed tomography (SBS-CT) and organ injuries sustained in head-on automobile collisions by utilizing original in-depth accident investigations data.
Methods: This retrospective study was conducted from September 2009 to August 2014. Of 3728 trauma patients admitted to our facility during the study period, 261 patients had in-depth accident investigations. Of these, 107 patients were eligible: they had been involved in a head-on collision while wearing a seat belt and undergone thoraco-abdominal CT. We compared two groups depending on the presence of intra-abdominal organ injury (group I: n=29) or not (group N: n=78). In this study, we defined SBS-CT that showed a subcutaneous high-density area on abdominal CT.
Results: Median age was 49 (interquartile range: 30-68) years and median injury severity score was 9 (4-17). SBS-CT was observed in 54 patients (50.4%). There were no differences in vehicle type or riding position between the two groups. SBS-CT in group I was significantly higher than that in group N (93.1% vs 34.6%, $P<0.01$) and equivalent barrier speed, which indicates velocity change over time, was also higher in group I (37.5 km/h vs 30 km/h, respectively, $P=0.02$). In addition, patients who had SBS-CT above the anterior superior iliac spine (ASIS) level had a significantly higher rate of intra-abdominal organ injury than those who had SBS-CT below the ASIS level (63.3% vs 33.3%, $P=0.028$).
Conclusion: SBS-CT was associated with intra-abdominal organ injury in head-on collision. In particular, the location of SBS-CT above the ASIS level may facilitate the diagnosis of such injury.

Poster # 7

MANAGEMENT AND OUTCOMES OF RECTAL TRAUMA: A TEN YEAR RETROSPECTIVE REVIEW IN A LEVEL ONE TRAUMA CENTER

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Introduction: Management of rectal trauma continues to be a clinical challenge. Prognostic factors are poorly defined and there is a general lack of consensus on management pathways of some types of rectal injury, specifically with regard to the use of presacral drainage (PSD). The purpose of this study is to examine the 10 year experience at our trauma center to identify prognostic factors and outcomes of the different treatment modalities.

Methods: A retrospective review was conducted using the trauma registry of an urban Level 1 trauma center. -Trauma patients with suspected rectal injury between 2004 and 2014 were included in the analysis. Subjects were categorized as blunt versus penetrating and diagnostic and treatment methodology was examined. Short and long term outcomes and complications were noted and data were analyzed using chi-square analysis and student's t-test (Graphpad Prism).

Results: A total of 80 subjects were identified as having suspicion of rectal injury based on mechanism of injury or clinical findings. Five subjects were ruled out for rectal injury on proctoscopy, whereas 3 patients were noted to have rectal injuries missed initially on clinical exam. Two subjects were excluded from analysis due to incomplete records, and two more patients were excluded from final analysis due to death from multisystem trauma within 24 hours of arrival. Of the remaining 68 patients, 59 (87%) suffered penetrating injuries while 9 (13%) suffered blunt trauma. The majority of subjects suffered extraperitoneal injuries (53, 72%) and 12 (20.8%) patients overall suffered pelvic complications (PC) defined as pelvic sepsis or pelvic abscess. Two subjects died of complications of pelvic sepsis (overall attributable mortality 2.8%). Operative management varied between providers, with approximately 1/3 of patients receiving PSD and 64 (94%) undergoing fecal diversion (FD) with or without repair of injury. Five patients (7%) underwent primary repair of rectal injury (2 intra- and 3 extra-peritoneal) without FD and without PC. Of those patients with extraperitoneal injuries, the use of PSD appeared to prevent PC but this did not reach statistical significance ($p=0.05$, 95% CI 0.64-1.08). Blunt injury had a higher mean Injury Severity Score (2.1 vs. 2.4, $p=0.01$), was associated with greater risk of pelvic complications ($p=0.02$, RR=3.3, 95% CI 1.4-7.4) and attributable mortality (18% vs. 1%) compared to penetrating trauma.

Conclusion: Rectal injuries remain a therapeutic challenge in many instances. Although quite rare, blunt rectal injuries have a higher severity and were associated with greater morbidity and mortality when compared with the more common penetrating injuries. The use of PSD for extraperitoneal injuries was frequently used, was not associated with any complications, and may prevent pelvic complications, although this did not reach statistical significance in our cohort. The majority of surgeons performed FD to treat both intra- and extra-peritoneal rectal injuries. In a few instances, direct repair of rectal injuries was possible without significant complications.

Poster # 8

USE OF A NOVEL SALINE/BIPOLAR RADIOFREQUENCY ABLATION ENERGY INSTRUMENT FOR ARRESTING ONGOING SOLID ORGAN SURFACE AND LACERATION BLEEDING IN CRITICALLY INJURED PATIENTS.

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Introduction: Solid organ (liver, spleen and kidney) hemorrhage is often life threatening and can be difficult to stop in critically ill patients. Traditional techniques for arresting this ongoing bleeding include coagulation by high voltage cautery (Bovie), topical hemostatic application, and the delivery of ignited argon gas. The goal of this study was to evaluate the efficacy of a new energy device for arresting ongoing solid organ bleeding.

Methods: A novel instrument utilizing bipolar radiofrequency (RFA) energy which acts to ignite/boil dripping saline from a small, easy to manipulate hand piece was employed to arrest ongoing hemorrhage from solid organ injuries at 2 high volume, level 1 trauma centers. This instrument is ubiquitous in elective hepatic resections. Standard statistical and cost methodology was employed ($p<0.05$ = significant).

Results: From January 2013 to January 2015, 33 severely injured patients (mean injury severity score = 28; blunt mechanism = 31/33 (94%)) underwent use of this new saline/RFA energy instrument to arrest ongoing hemorrhage from the liver (26), spleen (5) and kidney (2). Of these patients, 23 received instrument use during an initial laparotomy, while 10 patients underwent use following removal of sponges during a return laparotomy after an initial damage control procedure. Success in arresting ongoing hemorrhage was 97% (32/33). The surgeons reported an ‘ease of use’ score of 4.8 out of 5. No postoperative complications (including delayed hemorrhage) were noted as a direct result of the energy instrument. When compared to matched historical controls, blood loss and the number of repeat laparotomies were less ($p<0.05$), but no difference in perioperative transfusion requirements, morbidity or mortality were noted ($p>0.05$).

Conclusion: This novel saline/RFA energy instrument has the potential to arrest ongoing solid organ surface/capsular bleeding, as well as moderate hemorrhage associated with deep lacerations. It is simple to use and cost effective.

Poster # 9

MICROARRAY ANALYSIS OF GENE EXPRESSION PROFILES IN OBESE PATIENTS FOLLOWING SEVERE TRAUMA

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Introduction: Obesity alters a number of acute and chronic medical conditions. The effect of obesity on severely injured trauma patients remains incompletely defined. We sought to unravel potential genomic alterations induced by obesity in severely injured blunt trauma patients. A retrospective review of genomic information contained in the Inflammation and the Host Response to Injury ^{TM} multicenter trauma-related database examining the relationship between body mass index (BMI) and genomic response from peripheral blood neutrophils following severe blunt trauma was performed.

Methods: Two hundred twenty two severely injured trauma patients were categorized using the National Institutes of Health/World Health Organization BMI classification system into four groups with BMI (kg/m^2) of 18.5–24.9 normal weight, 25–29.9 overweight, 30–39.9 obese and greater than 40 morbidly or extremely obese. Blood leukocytes were separated into neutrophils, monocytes and lymphocytes. Neutrophil genomic analysis was completed using Affymetrix Glue Grant Human Transcriptome (GG-H) Arrays™ obtained at seven standardized time points.

Results: Hierarchic clustering analysis demonstrated 645 genes that varied significantly between BMI groups (FDR 0.001). Time series analysis revealed 9407 genes that varied significantly between BMI groups (FDR 0.001). Examining the impact of BMI group and time revealed 553 genes that varied significantly with BMI classification over a 30 day period. Interesting the morbidly obese group (BMI>40) genomic alterations failed to return to baseline unlike the three lesser BMI classifications. Pathway analysis revealed that the significantly altered gene transcripts that varied with time and class represented interferon signaling, cell cycle proliferation, cell signaling, cytokine/chemokine signaling, cellular adhesion molecular signaling, interleukin 8 signaling, purine metabolism and reactive oxygen species production.

Conclusion:In this study we demonstrated that peripheral blood neutrophil genomic signatures vary significantly with BMI class in severely injured trauma patients. Pathway analysis revealed that the genomic alterations represent immune function and interferon signaling pathways consistent with neutrophil function. Moreover, the most morbidly obese cohort demonstrated a genomic signature that did not return to baseline over time. These findings indicate that an underlying contribution of body mass to genomic alterations in severe trauma exist and may account for the protective effect of obesity seen in severe trauma patient populations.

Poster # 10

DEFINING RATES AND RISK FACTORS FOR READMISSIONS FOLLOWING EMERGENCY GENERAL SURGERY

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Introduction: Emergency general surgery (EGS) patients are at increased risk for postoperative complications. Studies have shown that postoperative complications are closely linked to hospital readmission. However, there are few data on readmissions after Emergency General Surgery (EGS) procedures. We sought to define readmission rates and identify risk factors for readmission after the most common EGS procedures. Our hypothesis was that surgical complications as well as demographic factors will contribute to the rates of readmission in the EGS population.

Methods: The California State Inpatient Database (2007-2011) was queried for EGS patients as defined by the American Association for the Surgery of Trauma (AAST). Patients (age ≥18 years) with emergency department admissions, undergoing general surgery procedures the day of admission were included. We identified the 5 most commonly performed EGS procedures in each of 11 EGS diagnosis groups defined by the AAST. Patient demographics (sex, age, race, insurance type) as well as Charlson score, length of stay, complications and discharge disposition were collected. The primary endpoint was 30-day readmission. Secondary endpoints were location and reason for readmission. Factors associated with readmission were determined using multivariate logistic regression models.

Results: Among 177,511 patients meeting inclusion criteria, 57% were white, 49% were privately insured, and most were ≥45 years old (51%). Laparoscopic appendectomy (35%) and laparoscopic cholecystectomy (19%) were the most common procedures. The overall 30-day readmission rate was 5.8%. Based on diagnosis groups, readmission rates ranged from 4.1% (Upper Gastrointestinal) to 16.8% (Cardiothoracic). Of the patients who were readmitted at 30 days, 17% were readmitted at a different hospital. Predictors of readmission included Charlson score ≥2 [adjusted odds ratio: 2.26 (95% Confidence Interval: 2.14-2.39)], leaving against medical advice [2.24 (1.89-2.66)], and public insurance [1.55 (1.47-1.64)]. Major predictors of readmission at a different hospital were leaving against medical advice [1.99 (1.40-2.85)] and paying out-of-pocket [1.67 (1.33-2.11)]. The most common reasons for readmission were surgical site infections (17%), gastrointestinal complications (11%), and pulmonary complications (4%).

Conclusion: Readmission after EGS procedures is common and varies widely depending on patient factors and initial diagnoses. One in five readmitted patients will go to a different hospital, potentially obscuring the utility of readmission as a quality metric. Assisting socially vulnerable patients, reducing post-operative complications and infections are targets to reduce readmissions.

Poster # 11

THROMBOELASTOGRAPHY DOES NOT DETECT PRE-INJURY ANTICOAGULATION THERAPY IN ACUTE TRAUMA PATIENTS

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Introduction:The aging trauma population presents with a higher incidence of pre-existing medical conditions, including the use of anticoagulation (AC) therapy. Viscoelastic methods, such as thromboelastography (TEG), have been recommended to characterize post-traumatic coagulopathy, yet no study has evaluated the impact of pre-injury AC on TEG. We hypothesized that patients on pre-injury AC would have a greater incidence of coagulopathy on TEG.

Methods:This retrospective chart review evaluated all trauma patients admitted to an urban, level one trauma center from February 2011 to September 2014 who received a TEG within the first 24 hours of admission. Propensity score 1:1 matching for age, gender and injury severity score was used to ensure similarity of the two groups. Patients were classified as pre-injury AC if their documented medications prior to admission included warfarin, dabigatran, or anti-Xa (aXa) inhibitors (apixaban or rivaroxaban). Patients were excluded if they received a hemostatic medication (n=11) or blood product (n=28) prior to the TEG, lacked a matched pair (n=198), or had missing data (n=4). To assess the clinical application, the presence of coagulopathy on kaolin TEG and conventional laboratory was defined by exceeding local laboratory reference standards, including reaction time (R) greater than 10 min, angle less than 53 degrees, maximal amplitude less than 50 mm, international normalized ratio (INR) greater than 1.4 and activated partial thromboplastin time (aPTT) greater than 36.5 seconds.

Results:A total of 54 patients were included (AC, n=27 [warfarin n=13, dabigatran n=6, aXa inhibitor n=8] vs. no AC, n=27). The time from admission to TEG was similar (AC 164 ± 315 min vs. no AC 220 ± 247 min, p=0.47). TEG coagulation markers differed, including the R value (AC 6.5 min ± 4.4 vs. no AC 4.3 min ± 1.1; p=0.01) and MA (AC 66.8 mm ± 5.02 vs. no AC 62.6 mm ± 6.8; p=0.01). The prolonged R value was driven by warfarin (R 5.5 ± 2.1 min vs. no AC 4.3 ± 1.1 min; p=0.03) and dabigatran (R 10.8 ± 7.6 min vs. 4.3 ± 1.1 min; p<0.01), not aXa inhibitors (R 4±1.7 min vs. no AC 4.3 ± 1.1 min; p=0.16). However, there was no significant difference in the number of patients determined to have coagulopathy on TEG by exceeding references ranges (AC 11.1% vs. no AC 3.7%; p=0.3). Traditional coagulation markers, including INR (AC 1.8 ± 0.84 vs. no AC 1.1 ± 0.14; p<0.01) and aPTT (AC 41.9 ± 20.5 sec vs. no AC 30 ± 5.1 sec; p=0.01), were prolonged in the pre-injury AC group. The INR was prolonged by all individual AC subgroups, including warfarin (2.1 ± 0.95 vs. 1.1± 0.14; P<0.01), dabigatran (1.4 ± 0.59 vs. 1.1 ± 0.14; p=0.01) and aXa inhibitors (1.6 ± 0.74 vs. 1.1 ± 0.14; p<0.01). The aPTT was prolonged in warfarin (41.3 ± 23.2 sec vs. 30.1 ± 0.03 sec; p=0.03) and dabigatran (52.7 ± 19.1 sec vs. 30.1 ± 0.03 sec; p<0.01), but not aXa inhibitors. Conventional tests identified coagulopathy in a high proportion of anti-coagulated patients (AC 74% vs. no AC 15%; p<0.01).

Conclusion:Warfarin and dabigatran prolonged the R value on TEG in a matched cohort, however; prolonged R values remained within normal laboratory reference ranges. Therefore, the TEG has limited clinical utility to evaluate the presence of pre-injury AC and traditional markers of drug induced coagulopathy (PT and PTT) remain standard of care to evaluate for pre-injury AC and guide reversal decisions.

Poster # 12

APPENDECTOMY SHORT STAY PROTOCOL DECREASES LENGTH OF STAY

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Introduction: Previous research has shown that uncomplicated appendectomy can be treated as an outpatient procedure. We wanted to determine if a short stay protocol improved value driven outcomes through shortening length of stay without compromising quality.
Methods: All patients undergoing appendectomy for acute, uncomplicated appendicitis at our tertiary academic medical center from October 1st 2012 to October 1st 2013 were compared to a control group from the prior year. Patients were divided into pre-protocol and post-protocol groups. Gathered data included demographic information, complications, readmission in 30 days, complications, time from admission to OR, OR time, OR to discharge time and total length of stay.
Results: Total stay was reduced by 8.3hrs (p=0.017), admission to OR was reduced by 1.9hrs (p=0.003), OR to Discharge reduced by 6.5hrs (p=0.049), OR times were similar. Age, admission WBC, gender, post-op complications, 30-day readmission, and complications were equivalent between the two groups.
Conclusion: Protocolized delivery of care for acute, uncomplicated appendicitis delivers improves value driven outcomes through improved care efficiency without compromising patient safety.

Table 1: Demographics

	Pre-Protocol	Protocol	P value
Appendicitis, n,(%)	161(49)	169(51)	
Gender, n, (%)			
Male	88(55)	88(52)	
Female	73(45)	81(48)	0.222
Age (SD)	34.5(15.4)	34.3(14.3)	0.876
Admission WBC (SD)	12.2(3.9)	12.9(3.9)	0.123

Table 2: Outcomes

	Pre-Protocol	Protocol	Difference	P value
Total Stay	34 hrs	26.6 hrs	8.3hrs	0.017
Admission to OR	9.2 hrs	7.3 hrs	1.9hrs	0.003
Total OR	49.4 min	53.2 min	3.8 min	0.206
OR to Discharge	24.8 hrs	18.3 hrs	6.5 hrs	0.049
Complications, % (admission)	16(10%)	12(7%)		0.431
Readmissions, %	21(13%)	20(11%)		0.74
Complications , %(clinic)	15(9%)	10(6%)		0.33

Poster # 13

DATA DICTIONARIES TO MEASURE DISEASE SEVERITY FOR 16 EMERGENCY GENERAL SURGERY ILLNESSES

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Introduction: The American Association for the Surgery of Trauma (AAST) recently developed a new grading system for measuring anatomic severity of Emergency General Surgery (EGS) diseases. However, its utility is hampered by a lack of uniform definitions. The goal of this study was to develop clear, concise, and explicit descriptions for each grade of EGS disease.

Methods: The AAST Patient Assessment Committee developed definitions for 16 EGS diseases. For each grade of each disease, we developed definitions based upon clinical, imaging, endoscopic, operative, and pathologic criteria. All definitions were reviewed and approved by the committee members by consensus.

Results: Data dictionaries were created for acute appendicitis, breast infections, acute cholecystitis, acute diverticulitis of the colon (provided as example in the Table), esophageal perforation, hernias (internal or abdominal wall), infectious colitis, intestinal obstruction, arterial ischemic bowel, acute pancreatitis, pelvic inflammatory disease, perirectal abscess, perforated peptic ulcer disease, pleural space infection, soft tissue infections, and surgical site infections. The committee recommends reporting a grade based on each of these criteria, and then assigning the highest grade to the patient.

Grade	Description	Clinical Criteria	CT Findings	Operative Findings	Pathologic Findings
I	Colonic inflammation	Pain, elevated WBC; minimal or no tenderness	Mesenteric stranding, colon wall thickening	NA	NA
II	Colonic microperforation	Local tenderness; no peritonitis	Pericolic phlegmon; foci of air; no abscess	Pericolic phlegmon; no abscess	Inflamed colon with mircroscopic perforation
III	Localized pericolic abscess	Localized peritonitis	Pericolic abscess	Pericolic abscess	Perforation
IV	Distant &/or multiple abscesses	Localized peritonitis at multiple sites	Abscess or phlegmon away from colon	Abscess or phlegmon away from colon	Perforation
V	Free colonic perforation with generalized peritonitis	Generalized peritonitis	Free air & free fluid	Perforated with generalized fecal purulent contamination	Perforation

Conclusion: We have developed uniform definitions for grading sixteen EGS diseases. These definitions may be used to train data abstractors for emerging EGS registries.

Poster # 14

PROLONGED PREOPERATIVE LENGTH OF STAY AS A RISK FACTOR FOR PROLONGED URGENT LAPAROSCOPIC CHOLECYSTECTOMY

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Introduction: The standard of care for acute cholecystitis is laparoscopic cholecystectomy (LC). Previous studies have reported that performing an urgent same-day LC is superior to delayed elective cholecystectomy. While this practice is ideal, it requires significant hospital resources. We sought to determine whether prolonged preoperative length of stay (LOS) was associated with worse outcomes.

Methods: This analysis involved a retrospective chart review of patients treated for symptomatic gallstone disease at a large municipal hospital between September 2012 and November 2013. Inclusion criteria were age ≥18 yrs who underwent cholecystectomy and had a diagnosis of cholecystitis on pathology. Medical records were reviewed and relevant data points were collected. Univariate linear and multivariate logistics regressions were performed to assess the correlation between time to operation and the 3 primary outcomes (operative time, postoperative length of stay, and total length of stay). Separate analyses were performed using preoperative LOS as a continuous and ordinal categorical (<36 hrs or ≥36 hrs) variable.

Results: 88 patients met all criteria for inclusion. For urgent LC, the mean (SD) preoperative LOS was 75.5 (±48.9) hrs, the mean operative time was 2.3 (±1.1) hrs and the mean postoperative LOS was 59.4 (±6.38) hrs. The average total LOS was 137.2 (±81.0) hrs. Using univariate linear regression, operative time increased by 3.2 minutes for every 10-hr increase in preoperative LOS ($p=0.007$). Total LOS increased 1.1 hours for every 1hr increase in preoperative LOS ($p<0.001$). These findings remained significant when adjusted for age and sex. There was no difference in operative time (2.04 hrs vs 2.4 hrs) ($p=0.2257$) or postoperative LOS (57.9 hrs vs 60.8 hrs) ($p=0.8528$) between patients receiving LC before or after 36 hrs, respectively. There was no significant association between preoperative LOS and conversion to open procedure.

Conclusion: This analysis reveals that increased preoperative LOS is associated with increased operative time and overall LOS. While same-day urgent LC requires the hospital to commit resources, the average hospital stay costs $1,600/day and the average OR time costs $62/min. Further analysis is needed to explore the potential cost savings.

Poster # 15

ACUTE CARE SURGEON'S ROLE IN OBSTETRICAL/GYNECOLOGIC EMERGENCIES (THE OBCAT ALERT)

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Introduction:

Overwhelming hemorrhage or other intra-abdominal complications may develop during or following obstetrical or gynecologic procedures and may require the expertise and surgical training of an acute care surgeon. The OB Critical Assessment Team (OBCAT Alert) was developed to facilitate the multiple resources at our institution to prevent morbidity and mortality related to complications during these procedures. We sought to review and characterize the Trauma surgeon's role in obstetrical and gynecologic emergencies.

Methods

We conducted a retrospective review of all OBCAT (OB Critical Assessment Team) alerts or emergency general surgery consults during an obstetrical case at our institution from 2008 to 2015. Similar to the county Trauma Alert system, an OB CAT Alert is a hospital based alert system designed to immediately notify OB, Anesthesiology, Trauma, the ICU, and Blood bank of a potential hemorrhagic catastrophe or other emergency during an OB case. This coordinated system was developed in response to a series of complicated OB cases in the years prior to this review.

Results

Since 2009, there has been 7 ± 3 OBCAT alerts/year. 15 patients required Trauma surgical intervention for overwhelming hemorrhage; of which 12 requiring damage control packing which was typically required following an emergency hysterectomy for continued post partum hemorrhage. There was an average of 21.1 ± 10 units of PRBC transfused in these cases. There were 21 other instances of emergent surgical intervention required during a primary obstetrical/gynecologic case not related to hemorrhage. 8 of these cases were related to adhesions or intestinal injury and there were 4 severe bladder injuries requiring repair. There were 7 additional cases of OB/GYN patients requiring surgical treatment by Trauma services post routine OB/GYN procedure. The most common reason was for severe wound complications. There were a total of 3 deaths (7% total mortality) during this time; 2 were from hemorrhage and intra-operative cardiac arrest.

Conclusions:

Emergency Obstetrical cases can be associated with high morbidity and mortality and may require damage control or other surgical techniques in cases of overwhelming hemorrhage. Acute Care Surgeons have a key role in the early critical assessment of these complicated cases and may provide skills and experience in managing a variety of surgical emergencies in non hemorrhagic cases as well.

Poster # 16

Risk Factors for Anastomotic Leak after Delayed Colonic Anastomosis after Damage Control Laparotomy in Emergency General Surgery Patients

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Introduction: Damage control laparotomies have become a standard part of practice in the trauma population. In the setting of hypothermia, coagulopathy, and acidosis, leaving patients in intestinal discontinuity has been proven to be a safe and effective temporizing measure until such physiologic derangements can be corrected. Surgeons experienced in DCL have extended this approach to emergency general surgery (EGS) patients, although, traditional approaches for colonic catastrophes usually include the use of colostomy or ileostomies over high risk anastomosis. Here we report our experience of colonic anastomosis after DCL and aim to identify risk factors for colonic anastomotic leak after colon resection.

Methods: A retrospective review was performed through a prospective database for all EGS patients receiving colonic resection at a single institution, academic center for the years 2009-2014. Patients were identified that underwent DCL that had delayed primary colonic anastomosis (DA), immediate colostomy or ileostomy placement (IO), or delayed ostomy placement (DO). Data were collected on patient demographics, preoperative and intraoperative laboratory values, morbidity, and mortality.

Results: Ninety-six EGS patients were identified that underwent DCL. 56 of these patients either underwent subtotal colectomy with an end ileostomy, or had a catastrophic insult and did not survive for a second operation and were excluded from the study. Of the 40 remaining patients, 42% (17 patients) underwent DA, 10% (4 patients) underwent IO, and 48% (19 patients) underwent DO. Overall mortality is high among EGS patients undergoing DCL at 35%. However, mortality was not significantly different among the groups with 35% in the DA group, 50% in the IO group, and 32% in the DO group ($p=0.49$). Of the patients that underwent DA, only 18% (3 patients) had any evidence of anastomotic leak. On univariate analysis, preoperative factors including transfusions, markers of shock (pH, lactate, use of pressors), markers of inflammation (WBC, temperature, tachycardia, hyperglycemia) were not predictive of anastomotic leak. Chronic steroid use approached significance ($p=0.2$) and comorbidities (diabetes, renal failure, and cirrhosis) were associated with anastomotic leak ($p=0.03$). Only comorbidities ($p=0.02$) predicted anastomotic leak on multivariate analysis.

Conclusion: DCL surgery has improved the morbidity and mortality in the trauma population, but remains controversial in the EGS patient. Although the use of colostomy or ileostomy placement is widely used, there is no difference in survival in patients that undergo DCL and delayed colonic anastomosis versus an ostomy placement. In the appropriate patient, delayed colonic anastomosis can be a safe option. However, patients with comorbidities, including diabetes, renal failure, and cirrhosis, are at risk for wound healing issues and remain at high risk for anastomotic leak after DCL.

Poster # 17

SMALL BOWEL OBSTRUCTION: TO OPERATE OR OBSERVE?

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Introduction: Small bowel obstruction (SBO) is a common and challenging problem for acute care surgeons. A clear challenge relates to the timing and need for surgery. Accordingly, the purpose of our study was to identify preoperative predictors of need for surgery after admission for SBO.

Methods: Our institutional acute care surgery database was queried for SBO for a seven-year period (2006-12). Thirty-seven variables, including demographics, past surgical history, physical examination findings, admission laboratories and vitals, as well as CT scan findings were abstracted from SBO charts. The SBO cohort was divided into operative and non-operative groups. The groups were compared across variables using appropriate univariate statistics, with a multivariate logistic regression model created for the operative cohort, identifying predictors of need for surgery.

Results: Of 419 SBO during the study period, 169 (40%) were operative. Univariate and multivariate analyses are displayed in tables 1 and 2.

Table 1. Univariate Analysis

Variable	No-Op (250)	Operative (169)	*p*
#PAS[1]	2.5±1.8	1.8±1.5	<0.001
WBC[2]	11.5±4.9	12.1±6.1	0.049
Glucose[3]	130±48	136±42	0.003
Prior SBO	42.4%	18.9%	<0.001
Prior SBO Op	18.0%	9.5%	0.016

[1]#PAS=Number of Prior Abdominal Surgeries, [2]WBC= White Blood Cell Count (k/uL), [3]Glucose (mg/dL)

Table 2. Multivariate Analysis

Variable		AOR[1]	95% CI[2] for AOR	*p*
#PAS		0.78	0.68-0.91	0.001
WBC[3] (Ref 4-12)	**<4,000**	7.1	1.2-40	0.027
	≥12,000	1.9	1.2-3.0	0.006
Prior SBO		0.36	022-0.59	<0.001
Emesis		1.8	1.1-3.0	0.032

[1]AOR=Adjusted Odds Ratio, [2]CI=Confidence Interval, [3]WBC= White Blood Cell Count (k/uL)

Conclusion: A significant number of SBO admissions will require surgery. The strongest admission predictor of need for surgery for SBO is leukopenia. Interestingly, prior abdominal surgery and prior surgery for SBO are protective; need for surgery is inversely related to the number of prior surgeries. No admission CT scan findings were predictive of need for surgery. We hope that our findings will assist in operative decision making for SBO and will contribute to the design of prospective studies of SBO.

Poster # 18

Importance of experts in acute interventional radiology techniques in an area of acute care surgery and medicine.

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Introduction: In the acute care setting, not only surgical techniques but also a variety of modalities is required to comprehensively treat a patient. Since acute interventional radiology (IR) techniques are becoming increasingly popular, acute in-house care experts in IR techniques could further improve the on-site acute care. It is hypothesized that the immediate availability of experts on acute care with IR techniques is a significant advantage for acute on-site care.
Methods: Acute care experts (with Japanese Association of Acute Medicine's Board certification) in IR techniques completed at least 1 year of training as a member of the endovascular team in the Radiology Department of another university hospital. It was arranged in such a way that at any time one of them was available to come to the hospital and perform IR within 1 h after the decision to perform IR was taken. After obtaining appropriate approval, a prospective study of daily referrals and procedures performed by trained acute care experts, including those performed out of hours, was undertaken.
Results: We performed an emergency therapeutic IR for 101 cases in 79 patients during past 2.5 years. The median patient age was 69 years and 57% of the patients were male. Of the 101 cases, 94% of the procedures were vascular IR and only 6 cases were non-vascular IR. Further, 50% of the procedures were performed in out-of-hours referrals. Main emergency IR procedures were arterial embolization (AE) for hemorrhage (59%). In cases of AE, 52% of the cases were that of trauma; others such as upper gastrointestinal bleeding comprised the remaining 48%. Three cases (3%) were performed AE with an interventional radiologist in the Radiology Department in daytime. The overall mortality rate was 22%, and the main causes of death were coagulopathy (8%) and brain death (8%). (Table)
Conclusion: Immediate availability of trained acute care experts to perform diagnostic and therapeutic IR in acute care setting seems to be of considerable benefit. A standard training program for acute care experts should be established to make it universally accepted tactical regimen.

Clinical characteristics			
Age (yr) -median (IQR)	69 (50–76)	**IR procedures** -n (%)	
Male -n (%)	45 (57)	Arterial embolization	60 (59)
Daytime -n (%)	51 (50)	Thrombus treatment	19 (19)
Out-of-hours -n (%)	50 (50)	Aneurysm treatment	16 (16)
Vascular IR -n (%)	95 (94)	Drainage	6 (6)
Non-vascular IR -n (%)	6 (6)	**Mortality** -n (%)	
Type of acute care -n (%)		Coagulopathy	6 (8)
Trauma	32 (32)	Brain death	6 (8)
Non-trauma	36 (36)	Pneumonia/ Sepsis	3 (4)
Neuro	33 (33)	Others	2 (3)

Poster # 19

Diagnostic value of intestinal fatty binding protein (I-FABP) for pneumatosis intestinalis

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Background: Pneumatosis intestinalis (PI) is known as a sign of a life-threatening bowel ischemia. Nearly half cases of PI are considered benign. The usefulness of lactate as a biomarker has been reported. We aimed to evaluate the utility of intestinal fatty binding protein (I-FABP) in the diagnosis of pathologic PI.

Methods: All consecutive patients who presented to our emergency department with PI were prospectively enrolled from January 2009 to December 2014. The diagnostic performance of I-FABP for pathologic PI was compared with that of other traditional biomarkers and various parameters.

Results: Seventy patients with PI were enrolled. Pathologic PI was diagnosed in 27 patients (39%). The levels of most biomarkers were significantly higher in patients with pathologic PI than those with non-pathologic PI ($p < 0.05$). ROC analysis revealed that the area under the curve (AUC) was highest for I-FABP (AUC = 0.82) in the diagnosis of pathologic PI. Among other parameters, age, history of heart failure, rate of hypotension, tachycardia and portal venous gas was significantly higher in patients with pathologic PI ($p < 0.05$). In multivariate analysis, the presence of hypotension (adjusted OR, 23.2; $p = 0.004$), and I-FABP of 9.7 or greater (adjusted OR, 22.8; $p < 0.001$) retained statistical significance as predictors of pathologic PI.

Conclusion: We demonstrated that high I-FABP value, in combination with hypotension, was clinically useful for pathologic PI. However, our study has a small number of samples, so there is a need for a multicenter large trial to confirm this result.

Biomarkers	Pathologic PI (n = 27)	Non-pathologic PI (n = 43)	*p*
Specific bowel marker			
I-FABP (ng/mL)	15.5 (5.3-52.9)	3.2 (1.7-6.7)	< 0.001
Inflammatory markers			
WBC (× 10^9/L)	10.0 (6.1-15.9)	8.1 (6.2-13.2)	0.473
CRP (mg/L)	11.8 (2.6 – 19.0)	2.0 (0.4-6.8)	0.003
Tissue ischemic markers			
BD (mEq/L)	1.4 (-1.2-7.7)	0.3 (-1.8-0.9)	0.018
Lactate (mg/dL)	40 (17.0 – 70.5)	19.0 (13.0 – 21.0)	0.001
Non-specific bowel markers			
AMY (U/L)	126.0 (62.0-269.0)	63.5 (48.0-97.0)	0.005
LDH (U/L)	330.0 (234.0 – 498.0)	228.0 (191.0 – 280.0)	0.002
AST (U/L)	35.0 (25.0 – 82.0)	25.0 (18.0 – 31.0)	0.003
CK (U/L)	99.0 (42.5 – 448.0)	79.0 (42.0 – 125.0)	0.66
Coagulation activity marker			
D-dimer (ug/mL)	5.5 (3.4-13.4)	3.4 (1.5-6.0)	0.012
Renal function markers			
BUN (mg/dl)	38.7 (29.2-58.7)	18.2 (12.4-33.9)	< 0.001
Cr (mg/dl)	1.5 (1.0-3.2)	0.9 (0.56-1.42)	0.003

Poster # 20

EVIDENCE FOR ROLE OF EPITHELIAL CYTOKINES IN INJURY-INDUCED PERSISTENT CRITICAL ILLNESS IN BLUNT TRAUMA PATIENTS

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Introduction: Immune dysregulation following trauma can lead to injury-induced persistent critical illness (IPCI). IPCI is observed clinically by prolonged ICU stays, multiple organ dysfunction (MODS), and increased susceptibility to nosocomial infection (NI). Epithelial barrier dysfunction is thought to contribute to both MODS and NI. Recent discoveries suggest that cytokines released from stressed epithelium (IL-25 and IL-33) can drive the activation of underlying immune cells in end organs which can lead to aberrant immune responses if excessive. We hypothesized that IPCI with NI would be associated with evidence of epithelial stress measured by increased levels of epithelial cytokines in severely injured trauma patients.

Methods: Using a clinical data base and biobank from 472 blunt trauma survivors, we performed a retrospective case–control study where 44 trauma patients with IPCI (ICU LOS >12 days)+NI were compared to 44 patients with an uncomplicated clinical course (ICU LOS < 7 days) and, no NI. The two cohorts were matched for demographics, injury severity (average ISS=26 for both sub-groups), and similar mechanism of injury (blunt trauma). Plasma was sampled 3 times within the first 24h and then from D1 to D7 post-injury, and assayed for IL-25 and IL-33. MODS score (Marshall score) was calculated daily from day 1 and up to day 7 post-injury. Two-way analysis of variance (ANOVA) and Area under the Curve (AUC) were used to determine statistical significance ($p<0.05$) and fold change respectively between the two sub-groups. Spearman Correlation Coefficient (cc) was performed to determine the association between epithelial cytokines and MODS score as well as levels of cytokine markers of the systemic inflammatory response (IL-6, IL-23, and MCP1).

Results: Patients with IPCI+NI had a significantly longer ICU length of stay (LOS), and days on mechanical ventilation when compared to patients with uncomplicated clinical course. In addition, patients with IPCI exhibited a higher degree of organ dysfunction suggested by a higher Marshall MODS score persistently elevated across D1 through D7. Circulating levels of IL-25, and IL-33 were significantly elevated upon admission and remained elevated in patients with IPCI+NI. In addition, MODS correlated positively with levels IL-25 (cc: 0.3, $p= 0.0003$) and IL-33 (cc: 0.31, $p= 0.0002$) in IPCI+NI patients as compared to patients with resolution. IL-25 and IL-33 levels correlated with IL-6, IL-23, and MCP1 levels calculated by AUC analysis over the first 24 hrs.

Conclusion: These data demonstrate that cytokines derived from stressed epithelial cells post-trauma in humans are elevated early and over time in critically ill trauma patients. The correlation between epithelial cytokines and markers of SIRS suggest that these recently described cytokines contribute to the early immune response to severe injury. Further studies are warranted to discern mechanistic insights of dysregulated inflammatory pathways to better understand the role of epithelial cytokines and their effect on immune cells.

Poster # 21

EARLY PROPRANOLOL AFTER TRAUMATIC BRAIN INJURY IS ASSOCIATED WITH LOWER MORTALITY

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Introduction:Beta adrenergic receptor blockers (BB) administered early after trauma blunts the cascade of immune and inflammatory changes associated with injury. BB are associated with improved outcomes after traumatic brain injury (TBI). Propranolol may be an ideal BB due to nonselective inhibition and its ability to cross the blood brain barrier. We determined if administration of propranolol early after TBI is associated with lower mortality.
Methods:A retrospective review of prospectively collected data was performed for all TBI patients from January 1 2013 to January 31, 2015. Patients with mild TBI, defined as head AIS <3, were excluded. Administration of early propranolol was at attending discretion. Dosing began within 24 hours after admission at 1 mg IV every 6 hours. Patients who received early propranolol after TBI (EPAT) were then compared to those that did not. Demographics and outcomes data including intensive care unit (ICU) length of stay (LOS), hospital LOS, complications during admission and mortality were compared. Multivariable regression analysis was performed to determine independent risk factors for mortality.
Results:Over the 2-year period 537 patients presented with moderate to severe TBI. Early propranolol was administered in 17% (92/537) of patients compared to 83% (445/537) who did not receive the drug. Similarities were noted in ISS≥16, GCS≤8, and admission SBP<90mmHg. Outcomes such as hospital length of stay (12.6 v 9.3 days, p= 0.07), ICU length of stay ≥ 5 days (21% v. 25%, p=0.41) and mortality (7% v 12%, p = 0.11) were also similar between both groups. On regression analysis controlling for age, GCS, SBP <90mmHg and ISS≥16, early propranolol predicted lower mortality (AOR 0.35; CI 0.13, 0.99; p=0.05).
Conclusion: After adjusting for predictors of mortality, early administration of propranolol after TBI was associated with improved survival. No adverse events were associated with propranolol administration. Future studies are needed to identify additional benefits as well as optimal dosing regimens.

	Total (n=537)	Propranolol (n=92)	No Propranolol (n=445)	*p*-value
Age (years)	56 ± 23.2	50 ± 20.5	57 ± 23.5	*0.004*
SBP < 90 (mmHg)	25 (5%)	4 (4%)	21 (5%)	*0.88*
GCS	13 ± 4.1	12 ± 4.2	13 ± 4.0	*0.11*
GCS ≤ 8	91 (17%)	19 (21%)	72 (16%)	*0.30*
ISS	20 ± 9.8	21 ± 8.9	19 ± 9.9	*0.05*
ISS ≥ 16	358 (67%)	66 (72%)	292 (66%)	*0.26*
Hosp LOS (days)	10.6 ± 12.8	12.6 ± 15.5	9.3 ± 10.6	*0.08*
ICU LOS (days)	4.1 ± 7.0	6.7 ± 9.3	3.6 ± 6.3	*0.003*
ICU LOS ≥ 5	129 (24%)	19 (21%)	110 (25%)	*0.41*
Mortality	61 (11%)	6 (7%)	55 (12%)	*0.11*

Risk Factor	Adjusted Odds Ratio (95% CI)	Adjusted p-value
Age > 65 (years)	4.54 (1.99, 10.36)	*< 0.001*
GCS ≤ 8	29.86 (13.00, 68.57)	*< 0.001*
SBP < 90	4.35 (1.48, 12.80)	*0.008*
ISS ≥ 16	4.65 (1.43, 15.09)	*0.010*
Propranolol	**0.35 (0.13, 0.99)**	***0.050***

Poster # 22

MURINE SEPSIS MODELS RECAPITULATE HUMAN GENERATION OF HUMAN MYELOID DERIVED SUPPRESSOR CELLS (MDSCs) WITH CHRONIC CRITICAL ILLNESS

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Introduction:We have postulated that generation of MDSCs after sepsis contributes to the development of Persistent Inflammation Immunosuppresion Catabolism Syndrome (PICS) after chronic critical illness. Recent publications (Seok et al, *PNAS*, 2013) debate the efficacy of animal research models; however, the FDA requires animal testing prior to the study of human subjects. Since human and murine myelopoiesis and MDSC phenotypic cell markers differ, we hypothesized whether isolated MDSCs after murine cecal ligation and puncture (CLP) were similar to human MDSCs after sepsis at a functional and genomic level.

Methods:Blood was obtained from 12 severe sepsis/septic shock and 11 healthy control subjects for phenotyping, functional analysis and genotyping of enriched MDSC ($CD33^{+}CD11b^{+}HLA\text{-}DR^{-/low}$) populations. Blood samples were drawn at seven and 14 days after sepsis. Cecal ligation and puncture (CLP) or sham B6 mice underwent splenic MDSC ($GR1^{+}$) isolation seven days after procedure. Human/murine MDSC RNA was extracted and genome-wide expression analysis was performed ($p<0.001$ f-test). Ingenuity Pathway Analysis (IPA) was performed. T-cell suppression assays by MDCSs were also conducted. Also, we identified the genes that were significant in the human model and in the mouse model and calculated the correlation on the fold changes of the common genes.

Results:Similar to our previous reporting of human post-sepsis $CD33^{+}CD11b^{+}HLA\text{-}DR^{-/low}$ cells, murine MDSCs seven days after CLP induce >90% suppression of both CD4+ and CD8+ T cells (4:1 MDSC:T cells). Transcriptomic analysis revealed commonalities in the two species: both had significant upregulation (HP and CYBB) and downregulation (MHCII/HLA and CCR3) of MDSC associated immunity genes. Canonical pathway analysis revealed both species had predicated alterations (towards immunosuppression) in antigen presentation, B cell development, dendritic cell maturation and IL4 signaling. Both species were predicted to have a decrease in cytoxicity of lymphocytes (z-score<-2). Pearson's correlation of the MDSCs post-sepsis between human and murine transcriptome analogues with significant alterations was R=0.69.

Conclusion:Although not a perfect analogue, human and murine MDSCs after sepsis are appropriate for comparison for immunotherapy. Both human and murine MDSCs become a significant leukocyte population chronically after sepsis and have similar function and similar, but not identical, transcriptomic expression patterns. Translational research regarding this leukocyte holds significant promise for future immunotherapy after sepsis to prevent PICS.

Poster # 23

A HIGH-VOLUME TRAUMA INTENSIVE CARE UNIT CAN BE SUCCESSFULLY STAFFED BY ADVANCED PRACTITIONERS AT NIGHT

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Introduction: Advanced practitioners (APs) have played an increasing role in the management of trauma patients. However, it remains unknown whether critically ill trauma patients can be successfully managed by APs. The purpose of this study was to examine the impact of night coverage by APs in a high-volume Trauma Intensive Care Unit (TICU) on patient outcomes and care processes.

Methods: After IRB approval, our institutional trauma registry was used to identify trauma patients admitted to the TICU during the night shift. During our study period, the TICU was staffed by APs during the night shift (7pm-7am) from Sunday to Wednesday and by resident physicians from Thursday to Saturday. On-call trauma fellows and attending surgeons in house supervised both APs and resident physicians. Patient outcomes and care processes by APs (AP group) was compared with those admitted by resident physicians (RP group) using univariate and multivariate analyses.

Results: A total of 289 patients were identified between 7/2013 and 2/2014; median age 40, 77.9% male, 22.8% penetrating mechanism, 30.4% ISS≥25, 20.1% admission GCS<9. Median lactate clearance rate within 24 hours of admission were similar between two groups (10.0% vs. 9.1%, p=0.39). APs and resident physicians transfused patients requiring massive transfusion with a similar blood product ratio (PRBC:FFP) (2.1:1 vs. 1.7:1, p=0.32). After clinically important covariates were adjusted in multiple logistic regression analysis, APs coverage was not associated with any clinical outcome differences including in-hospital mortality, length of hospital stay, ICU stay and ventilation days.

APs (vs. RP)	Mortality	HLOS ≥14 days	ICU LOS ≥4 days	Ventilation days ≥7 days
OR (95%CI)	0.36 (0.11-1.16)	0.94 (0.51-1.73)	1.43 (0.76-2.63)	1.34 (0.60-3.00)
p value	0.08	0.84	0.25	0.47

Conclusion: Our data suggest that a high-volume TICU can be staffed by APs during the night shift with adequate supervision. In the era of resident work-hour restrictions, further examination of the outcomes associated with integration APs into the care of trauma patients is warranted.

Poster # 24

NIL PER OS: TO BE OR NOT TO BE?

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Introduction: Although recent guidelines have recommended a shift in fasting policy from the standard '*nil by mouth* (NPO) from midnight' approach to more relaxed policies, NPO is frequently ordered in mechanically ventilated patients for extra-abdominal procedures. Thus far, less information is available regarding the effects of enteral nutrition interruption due to NPO in the critically ill and intubated trauma patients. We hypothesize that the frequency of NPO worsens the nutritional status and has a negative impact on the clinical outcomes after trauma.

Methods:We retrospectively reviewed all 311adult trauma patients over a period of 4 years. These patients were intubated, admitted to the ICU for more than 14 days at our Level I trauma center, and underwent different surgical procedures. The patient's demographics, number of NPO from midnight for procedures, and other clinical data were extracted from the electronic and paper medical records.

Results:The majority of the patients (92%) had a blunt mechanism in injury. The median age was 50 (IQR 34). The median ISS was 27 (IRQ 14). The male to female ratio was 2.7:1. Among 1,211 total procedures performed on these patients, only 267 procedures (22%) were abdominal related, and a total of 887 NPOs were ordered. As shown in Table 1, the frequency of NPO was significantly correlated with the percent decrease of serum albumin, %lymphocytes and BMI. Multivariate regression analysis showed that the frequency of NPO was a predictor of ICU LOS, hospital LOS and ventilator days (Table 2), but not the hospital mortality.

Conclusion:There is a significant association between the frequency of NPO and nutritional deterioration and clinical in the critical ill and mechanically ventilated trauma patients. The majority of these enteral nutrition interruptions were most likely avoidable, since no GI surgery was involved and these patients had been intubated, unnecessary for airway manipulation. Further multicenter randomized prospective study is needed to further establish strategies to reduce NPO in order to improve the nutrition status and clinical outcomes of our critically injured trauma patients.

Table 1. Association between #NPO and variables (Spearman correlation coefficient and 95% CI using Fisher's Z transformation)

% Decrease	n	R	95% CI	*p* value
Albumin	267	0.266	0.151,0.374	<0.001
Pre-albumin	166	-0.038	-0.189,0.115	0.626
% Lymph	274	0.177	0.060,0.290	0.003
BMI*	190	0.202	0.061,0.335	0.005

Table 2. Multiple regression model predicting clinical outcomes

	R	95% CI	*p* value
ICU LOS			
#NPO	9.180	5.090,13.270	<0.001
#Procedures	-2.730	-5.070,-0.390	0.023
Age (yr)	0.015	-0.176,0.206	0.878
ISS	0.188	-0.183,0.559	0.320
Male	1.960	-6.850,10.770	0.661
Hosp LOS			
#NPO	11.160	6.530, 15.780	<0.001
#Procedures	-2.860	-5.500, -0.210	0.034
Age (yr)	0.054	-0.161, 0.270	0.621
ISS	0.196	-0.223, 0.616	0.358
Male	1.840	-8.120, 11.790	0.717
Vent days			
#NPO	5.370	2.540, 8.200	<0.001
#Procedures	-1.640	-3.249, -0.031	0.046
Age (yr)	0.071	-0.070, 0.212	0.321
ISS	0.284	0.019, 0.550	0.036
Male	1.950	-4.440, 8.340	0.549

Poster # 25

LACTATE CLEARANCE, AGE OF BLOOD AND SURVIVAL IN MASSIVELY TRANSFUSED TRAUMA PATIENTS: MAYBE FASTER AND YOUNGER IS BETTER

Andrea Lubitz MD, Kathryn Hollenbach Ph.D., Thomas Santora* MD, Elaine Chan MD, Elizabeth Dauer MD, Lars Sjoholm MD, Abijit Pathak* MD, Amy Goldberg* MD, Joseph Rappold* MD, Temple University School Of Medicine

Introduction: The development of lactic acidosis in critically injured trauma patients is a marker for oxygen debt and hypoperfusion. The relationship between clearance of lactate and the development of complications and survival is not well understood. Additionally, the age of blood utilized in massive transfusion protocol (MTP) patients may also contribute to the rate with which lactate is cleared. The clinical significance of these relationships remains poorly understood.

Methods: A retrospective cohort study of all MTP patients, treated between 2008 and 2012, at an urban level 1trauma center was undertaken. Data were abstracted from blood bank, trauma registry and patient medical records and included standard demographic information, injury severity score (ISS), mechanism of injury, amount and age of packed red blood cells received, lactate levels upon admission and at 12/24/48 hours post admission. Data were analyzed using STATA 13.1. Initial comparisons were made using Fisher's exact and Wilcoxon rank sum tests for categorical and continuous data, respectively. Logistic regression was used to examine the association between age of blood and lactate clearance while controlling for confounding effects.

Results: A total of 133 MTP patients were identified between 2008 and 2012. Excluded were 17 patients who did not survive 12 hours or who did not have an admission and 12 hour lactate level measured. One hundred sixteen MTP patients comprised the study population. One hundred percent of patients who cleared their lactate by 12 hours (n = 8) survived as compared to 58.1% (n = 18) of patients with abnormal 12 hour lactate values (Fisher's exact test; p = 0.03). The median percent of blood$\leq$ 14 days of age was 38.6% (0%, 86.2%) among 12 hour lactate clearance patients as compared to 2.6% (0%, 30.7%) among non-12 hour clearance patients. After adjusting for the confounding effect of infectious complication, patients who received $\geq$ 50% of transfused blood that was $\leq$ 14 days of age were 10.8 time more likely to clear lactate accumulation at 12 hours than patients who received < 50% of transfused blood$\leq$14 days of age (95% CI = 1.03, 113.62).

Conclusion: In this small observational study, MTP patients who cleared their lactate accumulation by 12 hours demonstrated significantly improved survival, and were more likely to have received at least 50% of transfused blood that was$\leq$14 days of age when compared to MTP patients who did not clear lactate accumulation by 12 hours. Further studies are warranted to examine these potential associations.

Poster # 26

DO PROCALCITONIN LEVELS RELIABLY DISTINGUISH PNEUMONIA FROM SYSTEMIC INFLAMMATORY RESPONSE SYNDROME PRIOR TO AVAILABILITY OF BRONCHOALVEOLAR LAVAGE RESULTS IN TRAUMA PATIENTS

Ashley Mooney MD, Elizabeth Palavecino MD, Jason Hoth* MD, Michael Chang* MD, Amy Hildreth* MD, Nathan Mowery* MD, Shayn Martin* MD, Jessica Gross MD, James Holmes* MD, Jeffery Carter Preston Miller* III, MD, Wake Forest University Department Of Surgery

Introduction: Procalcitonin (PCT) has been extensively studied as a biomarker in septic patients and has been touted as a tool which may distinguish systemic inflammatory response syndrome (SIRS) from sepsis. This distinction is difficult when considering the diagnosis of pneumonia (PN) in ventilated trauma patients, and bronchoalveolar lavage (BAL) is commonly used for this purpose. Antibiotics are stopped if the BAL is negative, indicating SIRS rather than pneumonia. Appropriate antibiotic therapy reduces mortality in PN, but excess antibiotic use is linked to worsening resistance patterns in nosocomial bacteria. While cultures take 24 to 96 hours to provide actionable results, PCT levels are available in a matter of hours. Our goal was to determine if PCT levels could reliably predict a negative BAL, thus allowing antibiotics to be safely stopped sooner.

Methods: This is a retrospective study of ventilated trauma patients suspected of pneumonia in our intensive care unit. All BAL results were reviewed and correlated with PCT levels drawn at the time of BAL (PCT1) as well as 12 hours after BAL (PCT12). A positive BAL was defined as growth of $>10^5$ CFU/mL. ROC curves were constructed and sensitivity, specificity, positive and negative predictive values were calculated using a cutoff of 0.20 ng/mL.

Results: From 11/13 – 8/14, 51 intubated trauma patients underwent BAL because of suspicion for PN due to SIRS. Sixty-nine percent (35) were found to have PN based on positive BAL. Area under ROC curves for PCT 1, PCT12, and Δ PCT for distinguishing PN from SIRS were 0.64, 0.83, and 0.58 respectively. Sensitivity and positive predictive value for PCT12 (best area under ROC curve) using a cutoff of 0.20 ng/mL were 80% and 91% respectively while specificity and negative predictive value were only 60% and 38%. Specificity and negative predictive value worsened at lower cutoffs of 0.15 ng/mL and 0.10 ng/mL.

Conclusion: Based on ROC curve analysis, PN in ventilated trauma patients is best predicted by PCT12. However, the poor specificity and negative predictive value of the biomarker in this setting do not allow for the safe discontinuation of antibiotics prior to final BAL results.

Poster #27

QUANTITATIVE POLYMERASE CHAIN REACTION (qPCR) OF CLOSTRIDIUM DIFFICILE TOXIN GENE SEQUENCES FROM SYSTEMIC SOURCES: A FEASIBILITY STUDY TO INDEX DISEASE SEVERITY

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Introduction: Risk scoring systems to identify patients at risk for fulminant *Clostridium difficile* infection (CDI) have been developed but may not predict patients at risk for medical failure or need for surgical intervention. Rapid diagnosis of CDI has improved with the availability of a real time qualitative PCR assay to detect *C. difficile* toxin gene in the stool. Recent animal models have demonstrated a strong correlation between severe CDI and *C. difficile* toxin detection in systemic blood. We postulated that a qPCR assay for *C. difficile* toxin gene product isolated from "systemic" sources would provide an accurate index of CDI severity. This was studied in an *in vitro* model.
Methods: HT29 colonic intestinal epithelial cell (IEC) monolayers were established in a two chamber system and apical media inoculated with live *C. difficile* bacteria. Monolayer integrity was indexed by permeability to FITC-dextran probe and basal media IL-1β and IL-8 as markers of inflammation. Basal chamber supernatants (non-luminal or "systemic" source) were also analyzed for tox A and tox B (ELISA) and *C. difficile* toxin gene products determined by qPCR. Cycle threeshold (Ct) and copies of toxin DNA/reaction were used to index qPCR.
Results: (mean ± SD; N = 4 for each group)

	Perm. (nmol/cm^2/hr)	IL-1 β (pg/ml)	IL-8 (pg/ml)	Tox A (ng/ml)	Tox B (ng/ml)	Ct value	Toxin DNA/ reaction
HT29 control	0.34±0.03	37.2±2.1	29.8±2.8	-----	-----	-----	-----
HT29+102 *C. diff.*	0.95±0.06*	111.4±4.0*	51.7±3.7*	12.4±2.8	16.1±3.5	27.9	1.6x103
HT29+104 *C. diff.*	1.16±0.11*	278.6±6.6*	79.3±4.1*	16.6±3.5	21.2±3.9	25.9#	2.4x104
HT29+106 *C. diff.*	1.28±0.10*	418.0±6.3*	95.3±4.6*	38.5±4.1#$	46.6±3.7#$	24.7#	6.3x104$

*p<0.001 vs. HT29 control, #p<0.001 vs. HT29 + 102 and 104 *C. diff.,* $Pearson r ≥ 0.9991 and 0.9989 for HT29 + 106 *C. diff.* and tox
A and B respectively. Ct value ≤ 29 is a strong positive reaction indicative of abundant target nucleic acid in the sample.
Conclusion: *C. difficile* toxin gene product qPCR indexed IEC barrier failure and "systemic" *C. difficile* toxin levels. This may be a useful biomarker to guide response to medical/surgical treatment and may have a role in prognostication.

Poster # 28

Elevated Serum neutorphil gelatinase-associated lipocalin (NGAL) is an early marker of acute kidney injury and associated with mortality in critically ill major trauma patients

Sung Jeep Kim MD, College Of Medicine, The Catholic University Of Korea

When creating your abstract, the only section headers to be used are listed below and they need to be in this format:

Introduction:
The main causes of late mortality in major trauma patients are sepsis and multi-organ failure. Acute kidney injury (AKI) is a one of important factors that effect on survival of major trauma patients. So, effective early diagnosis of AKI is important to management of critically ill major trauma patients. NGAL has been known as an early, sensitive, non-invasive biomarker for AKI. The aim of this study was to evaluate elevated serum NGAL levels as a predict of a early AKI and prognostic factor in major trauma patients

Methods:
We studied 65 major trauma patients (injury severity score>15) admitted to the intensive care unit of a trauma hospital retrospectively. NGAL was measured using an ELISA technique upon 24 hours after injuries. Presence of AKI during within5 days after trauma was defined by the risk injury failure loss and end-stage kidney classification (RIFLE) criteria.

Results:
A total of 65 patients (41 male, 24 female) were studied and mean ISS was 28.6 (16-53). A cut-off point of serum NGAL was larger than 153 ng/ml. 43 patients had elevated serum NGAL level and mean NGAL level was 314 ng/ml. patients with early AKI development was 37 and mean duration of development of AKI was 3.6 days. Elevated serum NGAL levels are associated with AKI (p=0.001), shock (p=0.022), ISS (p=0.031), age (p=0.008), baseline serum creatinine (p=0.23) and mortality (p=0.41). Multivariated analysis showed that lactic acid (p=0.017), base deficit (p=0.021) and shock (p=0.008) were statistically associated with mortality of major trauma patients.

Conclusion:
Serum NGAL from 24 hours of major trauma can be used as a reliable predictor of AKI and associated with mortality in major trauma patients

All images, charts and tables must be placed and uploaded in the body of your abstract exactly as you want them.

Poster # 29

CLINICAL UTILITY OF HTEE IN THE POST-RESUSCITATION PHASE OF TRAUMA PATIENTS RECEIVING MASSIVE TRANSFUSION PROTOCOL

Amy B. Christie MD, Brett Howard MD, Dudley B. Christie III, MD, Dennis W. Ashley* MD, Medical Center of Central Georgia/Mercer University School of Medicine

Introduction: Despite advances in trauma management and resuscitation, mortality still remains high for trauma patients with blunt or penetrating injuries presenting with massive hemorrhagic shock. At our institution, hemodynamic transesophageal echocardiography (hTEE) is being utilized as a hemodynamic monitoring tool to assess fluid responsiveness and ongoing resuscitation needs in patients who have received MTP. The purpose of this study was to demonstrate that in spite of receiving MTP, the majority of trauma patients when evaluated with continuous, real-time hTEE monitoring are initially under resuscitated (UR).

Methods: This is a retrospective study of trauma patients who received MTP and subsequent hemodynamic monitoring with Imacor hTEE (ZuraEVOZT1000) from January 2013 to December 2014. Demographics, volume status of the patient at time of hTEE probe placement, and time period to achieve optimization of the patient's resuscitation goals were analyzed. hTEE parameters that classified patients as fluid responders or under resuscitated (UR) were a superior vena cava (SVC) index >36% and a Left Ventricular End Diastolic Area (LVEDA) <10.

Results: 11 trauma patients were identified to have received both MTP and subsequent hemodynamic monitoring with an hTEE probe. The average Injury Severity Score (ISS) was 34. 7 of these patients had an Assessment of Blood Consumption Score (ABC) ≥ 2. Prior to hTEE probe placement, all 11 patients underwent some form of intervention to control homeostasis, 8 surgical and 3 arteriograms. The average time from initiation of MTP to hTEE probe placement was 14 hours. The average blood products transfused during MTP were 18 U RBCs, 14 U Plasma, 3U Platelets, and 3U Cryoprecipitate. Despite MTP resuscitation, 9 of 11 patients (88%) on initial hTEE assessment were classified as fluid responders (UR) by demonstrating an SVC index >36% and or LVEDA < 10. Only 2 of 11 patients (18%) demonstrated adequate resuscitation and were classified as fluid non-responders (euvolemic). No patient was determined to be volume overloaded. The time period from initiating hTEE monitoring and achieving a euvolemic state was broken down into three groups: 0 to 24 hours (h), 24-48 h, and 48-72 h. In the 9 of 11 patients initially identified as fluid responsive (UR): 2 obtained euvolemia in 0 to 24 h, 3 in 24-48 h, and 4 in 48-72 h. The longer it took for a patient to become adequately resuscitated seemed most related to the severity of the patient's injuries and the need for additional interventions. Also, an initial hTEE classification as a fluid non-responder did not translate into a patient remaining in that category. Of the two patients who were initially identified as euvolemic, one patient became volume overloaded in 24-48 h and the other patient transitioned back to a fluid responder (UR) in 0 to 24 h.

Conclusion: In patients having undergone MTP, initial hTEE assessment demonstrated that 88% of our patients classified as fluid responders (UR), despite high volume resuscitation. hTEE is beneficial in MTP as it allows for quick identification of patients in need of ongoing resuscitation as well as early recognition of patients that could benefit from a more restrictive resuscitation approach. Moving forward, incorporation of hTEE monitoring upon initiation of MTP rather than upon its completion would be beneficial to examine if hTEE influences the blood component requirements and MTP outcomes.

Poster # 30

THE ASSOCIATION BETWEEN METHAMPHETAMINE USE AND INTRA-OPERATIVE CARDIOVASCULAR EVENTS ("ICE") DURING EMERGENCY TRAUMA LAPAROTOMY

Meghan Kelly BA, Dennis Kim MD, Scott Bricker MD, Frederic Bongard* MD, Harbor-UCLA Medical Center

Introduction: The association of Methamphetamine (meth) use and cardiovascular performance with general anesthesia and emergency surgery is not well understood. The objective of this study was to determine if a meth positive toxicology screen is associated with intraoperative cardiovascular events (ICE) during emergency trauma laparotomy.
Methods: Registry data of patients who received a toxicology screen and underwent trauma laparotomy from January 1st, 2011 to December 31st, 2014 were retrospectively reviewed. Demographic, injury, admission physiologic, intra-operative and toxicology screen data were examined. ICE was defined as an arrest with or without intra operative death, an arrhythmia requiring specific intervention or the need for vasopressor support. In hospital mortality data was also examined.
Results: There were 239 patients meeting inclusion criteria where 13.4% (32) were in the meth (+) group. Overall mortality was 9.6% (23). There was at least one ICE in 26.8% (64) and intraoperative death in 0.8% (2) of patients. There was no significant difference in the incidence of ICE between meth (+) versus meth (-) patients [28.1% (9) versus 26.6% (55), p=0.817]. Additionally, there was no difference in overall mortality [6.2% (2) versus 10.1% (21), p=0.487] nor was there a difference in mortality in the ICE (+) group [22.2% (2) versus 20.0% (11), p = 0.878]. Adjusting for demographics, severity of injury, mechanism and intra-operative blood loss, a meth (+) screen was not associated with ICE or overall mortality.
Conclusions: Meth (+) trauma patients undergoing emergency laparotomy are no more likely to experience unfavorable intra-operative cardiovascular events than their meth (-) counterparts. Anesthetic concerns and preparation involving urgent surgical patients should be approached similarly, based upon disease or injury severity, regardless of meth toxicology screen results

Variables Associated with Intra-Operative Cardiac Events (ICE) During Emergency Trauma Laparotomy

Variable	P value	OR	95% CI
Severe injury (ISS $\geq$ 16)	0.020	2.141	1.126 - 4.071
Methamphetamine (+) screen	0.879	0.935	0.395 - 2.213

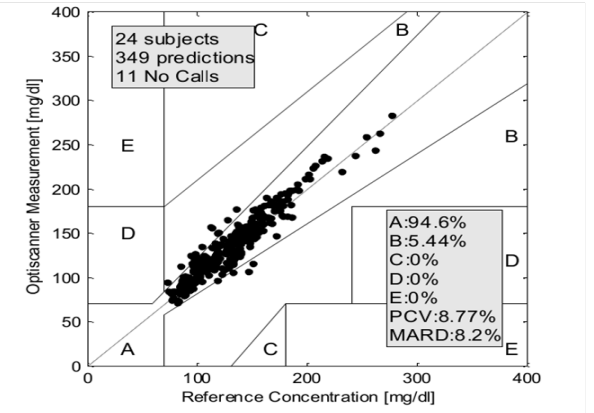
other variables: age, gender, mechanism, obesity, history of coronary artery or pulmonary disease, admission hypotension, intra-operative blood loss $\geq$ 500 ml

Poster # 31

RESULTS OF A NEAR CONTINUOUS GLUCOSE MONITORING TECHNOLOGY IN THE TRAUMA POPULATION

Grant V. Bochicchio* MD,MPH, Sara Buckman MD, PharmD, Eden Nohra MD, Stacey Reese RN, MS, Corinne Merrill RN, Jean Bundren RN, Douglas Schuerer* MD, Kelly Bochicchio RN, MS Washington University in St. Louis

Introduction: Numerous studies have shown that hyperglycemia is associated with worse outcome in critically injured trauma patients. Due to concerns related to hypoglycemia, targeted ranges of serum glucose have moved upwards due to the challenge of keeping patients in the desired range of 80-120 mg/dl. Increased glucose measurement frequency would increase Time in Range (TIR), avoid hypoglycemia and decrease the labor needed to obtain samples. Thus, we investigated the world's first usage of a near continuous glucose monitor in trauma patients. **Methods:** 24 critically ill trauma patients were enrolled at a Level 1 Trauma Center in which 319 samples were compared between the OptiScanner 5000 and the gold standard Yellow Springs Instrument (YSI) measuring glucose samples. The OptiScanner 5000 withdraws 0.13 ml of blood every 15 minutes from a central venous line, centrifuges the sample, and uses Mid Infrared spectroscopy to measure glucose. We assessed the data by plotting the Clarke Error Grid, Mean Average Relative Deviation (MARD) technique (to analyze the trend accuracy) and the population coefficient of variance (PCV), which is a traditional coefficient of variance, with the addition that it includes the effect of any bias. **Results:** A total of 94.6% of the data points were in the clinically useful "A" zone of the Clarke Error Grid. All 5.4% of the data points were in the clinically benign "B" zone, where it is presumed that no patient would be harmed. The MARD was below the 10% (8.2%), in line with literature suggesting likely prevention of hypoglycemia in ICU patients compared to manual methods. In addition the PCV was also less than 10 % (8.7%), also in line with literature suggesting that this method would be better than either every 2 hour or 1 hour measurements if achieved every 15 minutes for avoiding hypoglycemia, achieving a higher TIR and avoiding hyperglycemia and glucose variability. **Conclusion:** Our data suggests that the OptiScanner 5000 is accurate for usage in critically ill trauma patients, offering the promise of increased TIR, with the associated benefits of lower rates of hypoglycemia, hyperglycemia, and glucose variablity.



Poster # 32

BURN TRAUMA ACUTLEY INCREASES HEPATIC MITOCHONDRIAL O2 CONSUMPTION IN VIVO AND IN VITRO

Fredrick J. Bohanon MD, Xiaofu Wang BS, David N. Herndon* MD, Nisha Bhattarai BS, Tracy E. Toliver-Kinsky Ph.D., Labros S. Sidossis Ph.D., Craig Porter Ph.D., Ravi S. Radhakrishnan MD, University of Texas Medical Branch - Galveston

Introduction: The liver plays a significant role in the hypermetabolic stress response to burns due to its metabolic, inflammatory, and immune functions. In humans, cutaneous burn increases hepatic O_2 consumption. Here we examine the impact of burn trauma on mitochondrial O_2 consumption in the liver of burned mice and in cultured hepatocytes treated with scalded rodent serum (SRS).

Methods: Male BALB/c mice (8-10 wk old) had a 30% total body surface area scald burn created. Serum and liver samples were collected from six sham and five burn treated mice (24-hr post-treatment). HepG2 cells were grown and treated with SRS, control rodent serum (CRS) and normal growth medium (control) for 24-hr. Mitochondrial respiratory capacity was determined in fresh tissue and cells by high-resolution respirometry.

Results: *In vivo*, mitochondrial respiratory capacity was 79% greater in the liver of burned animals 1 day post injury when compared to sham treated animals (165.5±26.0 vs. 92.3±10.8 pmols/sec/mg; $P<0.05$). Similarly, *in vitro*, mitochondrial respiratory capacity was 92% greater in cultured hepatocytes treated with SRC compared to cells treated with CRS (43.1±1.2 vs. 22.5±1.2 pmols/sec/10^6 cells; $P<0.05$).

Conclusion: Cutaneous burn results in an acute increase in mitochondrial respiratory capacity in the liver, similar to the increased liver O_2 consumption seen in burn patients. These findings suggest that treatment of cultured hepatocytes with SRS offers an appropriate model to interrogate the impact of burn trauma on liver energetics *in vitro*.

Poster # 33

IMPACT OF HAPTOGLOBIN ON THE ASSOCIATION BETWEEN INFLAMMATION AND COAGULATION IN A RAT BURN MODEL

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Introduction: Severe burn injury characterized by systemic inflammation is often associated with multiple organ failure and ultimately a poor prognosis. Although haptoglobin (Hpt) known as hemoglobin (Hb) scavenger prevents renal impairment induced by massive hemolysis, little is known about organ protective effect other renal protection. We hypothesize Hpt might have a protective effect in other organs as well as due to its association with inflammation and coagulation.

Methods: Isoflurane-anesthetized rats of six-weeks of age (n=30) received a 30-40% full-thickness scald burn on the dorsal skin surface using the Walker-Mason model. All rats were injected with either haptoglobin or normal saline (NS) intraperitoneally immediately before the thermal stress. They were then divided into three groups: 1) control group (NS 20mL/kg), 2) L-Hpt group (Hpt 4mL (80U)/kg + NS 16mL/kg, 3) H-Hpt group (Hpt 20mL (400U)/kg). While under anesthesia, the rats of each group were euthanized by exsanguination at 6 hours (N=5) and 24 hours (N=5) respectively. Organ protective effects on kidney, lung and liver were then confirmed by pathological examination. Inflammatory and anti-inflammatory cytokines were measured and whole blood viscoelastic test were performed to evaluate coagulation status by thromboelastometry (ROTEM ®). All variables were statistically analyzed using SPSS® for Windows ver. 19.

Results: The Hpt significantly reduced free Hb (L-Hpt and H-Hpt, P=0.008) after 24 hours of the injury. Moreover, improvement of hematuria was confirmed in the H-Hpt group (P=0.027). There was no difference in the subject of thrombin-antithrombin complex (TAT). According to the analysis of inflammation related cytokines, the Hpt significantly decreased interferon (INF)-gamma (L-Hpt, P=0.043; H-Hpt, P=0.023). ROTEM findings of the L-Hpt group showed significantly higher clot firmness (A10, P=0.031; A20, P=0.023) and shorter time to maximum clot formation velocity (MAXVt, P=0.030) than the control group. However, the pathological analysis did not show any protective effect on the kidneys, lungs or liver. All animals survived in this study with the exception of one animal in the NS group, who died after 30 min of burn injury.

Conclusion: Haptoglobin reduced INF-gamma, may improve wound healing, and accelerate the stronger clot formation.

Poster # 34

OBESE MICE HAVE INCREASED INFLAMMATION AND MELANIN-CONCENTRATING HORMONE RECEPTOR EXPRESSION IN THE BRAIN AFTER TBI

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Introduction: Following a traumatic brain injury (TBI) event, the secondary brain injury that persists consists of heightened inflammation, neuronal cell death, and cognitive/mood disorders. Previously, obese patients that experienced a TBI had more complications and a higher mortality rate. To date, very little data exists that defines the relationship between obesity and neurological outcomes in TBI survivors. Here, we hypothesized that obese mice have increased inflammation and expression of an anxiogenic mediator, melanin-concentrating hormone receptor 1 (MCH1), in the brain after TBI.

Methods: In this study, diet-induced obese (DIO; 60 kcal% fat diet for 20 weeks) and control mice (10 kcal% fat diet) were injured using the controlled cortical impact (CCI) device. In brief, a midline incision was made to access the skull and the impactor tip was aligned directly on the skull on the sagittal suture midway between the bregma (-2.12 mm) and lambda sutures. The mice were injured at a depth of 1.25 mm, velocity of 3 m/sec, and a delay time of 100 msec to administer a mild-to-moderate TBI. At the indicated time-point, the animals were intra-cardially perfused with formalin and the brain was processed. The brain regions near the injury zone were stained for activated astrocytes (GFAP) and expression of the anxiogenic mediator, MCH1. **Results:** Compared to non-injured controls and injured mice fed the normal fat diet, the obese mice had a significant increase in the number of activated astrocytes within the cerebral cortex ($p < 0.01$) and hippocampus ($p<0.05$) at day 30 after TBI. In addition, on days 3 and 30 after TBI we found that the MCH1 levels were also elevated within the cerebral cortex (Day 3, $p<0.03$; Day 30, $p<0.01$) and hippocampus (Day 3, $p<0.001$; Day 30, $p<0.01$).

Conclusion: Increased expression of MCH1 after TBI may be a key pathway in the development of chronic secondary injuries such as prolonged neuro-inflammation and anxiety in obese TBI survivors. As a therapeutic strategy, antagonism of MCH1 after TBI may prove to be useful in improving neurological outcomes.

Poster # 35

ASSESSMENT OF THE PROGNOSTIC IMPLICATIONS OF SEVERE INFLAMMATORY RESPONSE SYNDROME (SIRS) IN TRAUMATIC BRAIN INJURY

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Introduction: A key component of traumatic brain injury (TBI) is the inflammatory response evoked by trauma. The systemic inflammatory response syndrome (SIRS) can lead to neuroinflammation and systemic tissue damage which can self-propagate into a detrimental cycle of hyperinflammation and increased damage. Here we aim to investigate the prognostic implications of SIRS in the TBI patient population of our Level II trauma center.

Methods: Adults (≥18 years) with isolated TBI admitted between 2009-2014 were identified in the trauma registry. Associations between SIRS and selected variables were analyzed using the X^2 test. The prognostic value of SIRS and each SIRS criterion were examined by logistic regression analyses.

Results: Of the 330 patients identified, 45 (13.6%) met SIRS criteria. Variables significantly related to SIRS were age (P<0.007), Glasgow Coma Score (GCS) (P<0.001), Injury Severity Score (ISS) (P<0.014), while sex and glucose (P<0.815 and P<0.114, respectively) were not. SIRS and each SIRS criterion were examined in relation to poor outcome (persistent vegetative state, severe disability, or death). The strongest predictors of poor outcome were presence of SIRS, body temperature, and white blood cell count at admission.

Table. Multivariate logistic regression of prognostic variables in relation to poor outcome

	OR	95% CI	P
SIRS	3.54	1.679-7.464	0.001
BT (<36°C or >38°C)	5.788	1.594-21.017	0.008
HR > 90	1.967	1.018-3.804	0.44
RR >20	2.572	1.098-6.026	0.3
WBC < 4000 mm^3 or >12000 mm^3)	2.073	1.092-3.937	0.026
Age > 60 years	0.352	0.161-0.768	0.009
Glucose at admit > 200 mg/dL	0.847	0.293-2.451	0.759

BT = body temperature; HR = heart rate; RR = respiratory rate; WBC = white blood cell count

Conclusion: Our data suggests that SIRS after acute TBI is a strong predictor of poor outcome. Future prospective studies aimed at therapeutic interventions to control or reverse SIRS in TBI patients are warranted.

Poster # 36

REPEATED DOSES OF METHYLENE BLUE AFTER TRAUMATIC BRAIN INJURY IMPROVES MOTOR COORDINATION AND REDUCES NEUROINFLAMMATION

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Introduction: Traumatic brain injury (TBI) is associated with immediate neuroinflammation that contributes to impaired functional recovery and long-lasting deficits. Unfortunately, there are no effective pro-active treatment strategies for TBI. Methylene blue (MB) is a blood brain barrier permeable antioxidant used clinically for septic shock and ischemia. Our lab has demonstrated that a single injection of MB after TBI decreased neuroinflammation and ameliorated depressive-like behavior, but had no effect on functional recovery. Thus, we hypothesized that multiple injections of MB would further decrease TBI-induced inflammation and improve functional recovery compared to vehicle controls.

Methods: Adult mice received a sham operation or moderate TBI using a fluid percussion injury model. Mice then received an intravenous (i.v.) injection of vehicle or MB (2 mg/kg) via the tail vein 15 min, 12 h, and 24 h post-injury. Twenty-four hours after injury the proportion of inflammatory cells in circulation and inflammatory gene expression in the brain and microglia were measured. Functi

Results: Multiple doses of MB decreased neuroinflammation after TBI compared to sham controls, but were not significantly different from a single dose of MB. Nonetheless, multiple doses of MB improved functional recovery whereas a single dose of MB was ineffective. Specifically, multiple doses of MB significantly increased motor coordination during the first week after injury compared to TBI mice treated with vehicle.

Conclusion: MB continues to show promise as the first pro-active treatment for moderate TBI to reduce neuroinflammation and improve functional outcomes. Moreover, repeated injection of MB was safe and more effective in improving functional recovery compared to a single injection.

Poster # 37

ABNORMAL INR AND MAJOR NEUROSURGICAL PROCEDURES FOR TRAUMA: WHEN IS IT CLINICALLY SIGNIFICANT COAGULOPATHY?

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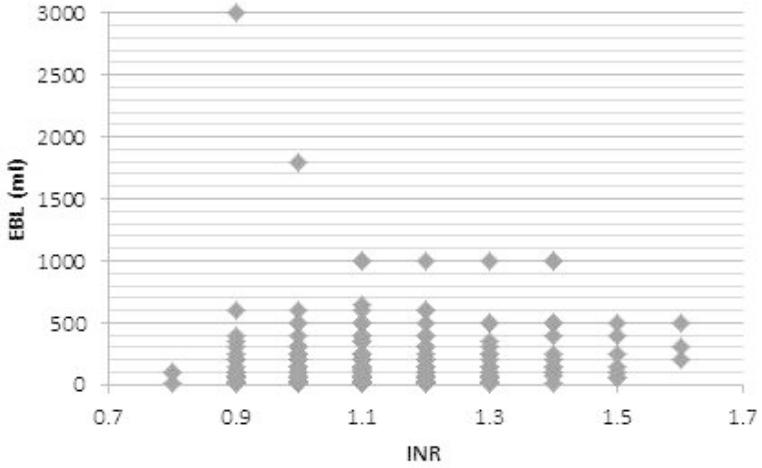
Introduction: Elevated international normalized ratio (INR) is frequently treated with fresh frozen plasma (FFP) or prothrombin complex concentrate (PCC) prior to neurosurgical procedures. The level at which elevated INR constitutes coagulopathy has not been established in prior reports. We hypothesized that in patients with an INR < 1.7, INR would not correlate with increased risk of bleeding, as determined by estimated blood loss (EBL) during surgery, FFP or PCC administration intraoperatively, progression of intracranial hemorrhage (ICH), or need for repeat intervention.

Methods: A retrospective review of patients undergoing craniotomy, craniectomy, or cranioplasty was performed at a Level I Trauma Center from 2012 to 2014. Patients were stratified by INR and data were analyzed using Chi square and Pearson correlation coefficient.

Results: 270 total patients were included in the study: 190 with craniotomy, 73 with craniectomy, and 7 with cranioplasty. Baseline demographics were similar between groups. In patients with INR < 1.7 (n=261), there was no correlation between INR and EBL ($r = 0.094$, $p = 0.13$) Compared to patients with an INR <1.4 (n=235), patients with INR 1.4-1.6 (n=26) received more FFP or PCC intraoperatively (9% vs 42%, $p < 0.001$), but there was no increased risk of progression of ICH (21% vs 23%, $p = 0.58$) or need for repeat intervention due to bleeding (8% vs 0%, $p = 0.13$).



Conclusion: In patients with an INR < 1.7, there is no correlation between INR and EBL. Urgent neurosurgical intervention should not be delayed for "correction" of an INR < 1.7.

Poster # 38

THERAPEUTIC ANTICOAGULATION AFTER TRAUMATIC INTRACRANIAL HEMORRHAGE

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Introduction: Traumatic Brain Injury (TBI) is a well described risk factor for Venous Thromboembolism (VTE). VTE rates after TBI without prophylaxis are as high as 58%. Many studies have demonstrated the safety of prophylactic anticoagulation after TBI, but progression of hemorrhagic TBI after initiation of VTE prophylaxis with LMWH was 14.5% in a Western Trauma Association study. Additionally, there is little in the literature regarding the safety of therapeutic anticoagulation following a TBI. This study was performed to determine if there was a difference in patients with or without hemorrhagic progression of TBI following the institution of therapeutic anticoagulation.

Methods: All Patients >18 years of age admitted to a level 1 trauma center from 6/2009 to 8/2014 with a diagnosis of TBI were screened for the development of VTE using a trauma registry. Patients without intracranial hemorrhage (ICH) on initial head CT were excluded. Basic demographic information was collected. All subsequent head CT reports were reviewed for progression of ICH. Data regarding anticoagulation type, dosing, and day of anticoagulation at time of progression were collected from the electronic medical record. Fisher's exact and Wilcoxon rank-sum test were used for statistical analysis.

Results: Of 139 patients admitted with a TBI and a VTE during initial hospitalization only 46 patients had ICH on initial head CT. After VTE diagnosis, 10 patients did not receive therapeutic anticoagulation due to presence of External Ventricular Drain or decision to withdraw life sustaining measures. Two patients had ICH progression with prophylactic anticoagulation. Thirty-three patients received therapeutic anticoagulation and progression occurred in 3/33 (9.1%). ICH progression occurred on median day 7 (IQR 2-17.5). Between patients with and without ICH progression, there were no significant differences in their hospital courses and no mortality difference.

(See table 1)

Table 1

	Progression, median (IQR)	No Progression, median (IQR)	p-value
Age	55 +/- 20	47 +/- 18	0.51
Mortality	0 (0%)	5 (16.6%)	0.44
ICU Length of Stay	18 (5 – 26)	12 (5.7 – 17)	0.51
Length of Stay	35 (25.6 – 42.7)	21 (14.3 – 31.5)	0.06
Ventilator days	11 (4 – 23)	8 (1 – 13.25)	0.43
Hospital Day Prophylaxis	7 (3 – 7)	5 (4 – 7)	0.96
Hospital Day VTE	14 (7.5 – 22)	9 (5.75 – 13)	0.14
Hospital Day Anticoagulation	15 (2 – 17)	10 (5.75 – 14)	0.70

Conclusion: This study noted no difference in patient demographics, timing of anticoagulation initiation, or difference in outcome. The small number of patients with progression of ICH suggests that even therapeutic anticoagulation is safe in patients with ICH but prospective studies are necessary to determine the earliest day that anticoagulation can be started. Until future studies are performed the decision to initiate therapeutic anticoagulation remains individualized and multifactorial, based on physician judgment. A prospective multicenter study is needed to accurately determine the earliest post trauma day at which anticoagulation can be safely initiated in patients with intracranial hemorrhage.

Poster # 39

DOES COMPLIANCE WITH THE SURGICAL MANAGEMENT OF TRAUMATIC BRAIN INJURY GUIDELINES RESULT IN IMPROVED OUTCOMES?

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Introduction: There are limited data regarding the impact of compliance with the Brain Trauma Foundation (BTF) surgical management guidelines on outcomes following traumatic brain injury (TBI). We hypothesized that compliance with the BTF guidelines for the evacuation of posttraumatic mass lesions would be associated with improved survival following TBI.

Methods: We performed a 2-year retrospective analysis of adult patients directly admitted to our level 1 trauma center with an admission diagnosis of TBI. Patients with devastating brain injuries and those with an isolated subarachnoid hemorrhage were excluded. Compliance was defined according to whether or not patients with acute subdural, epidural, and traumatic parenchymal lesions were managed according to the guidelines. Medical records and CT scans were reviewed for relevant serial clinical and radiographic data including Glasgow Coma Scale (GCS) scores, pupillary size and reactivity, midline shift, hematoma thickness, and volume. The primary outcome measure was survival to hospital discharge. Multiple logistic regression analysis was performed to identify independent predictors of survival.

Results: Of 231 patients, 180 (77.9%) were managed according to the surgical management guidelines. These patients were younger (53 vs. 62 years, p=0.01), had a lower incidence of subdural hematomas (63% vs. 78%, p=0.04), and were more likely to present with parenchymal lesions (32% vs. 16%, p=0.02). Intracranial pressure monitoring did not differ between groups (13.3% vs. 11.8%, p=0.77). Patients in the compliant group underwent surgical evacuation more frequently (21.7% vs. 2.0%, p=0.001). Unadjusted analysis demonstrated improved survival among patients in the compliant group (95.0% vs. 84.3%, p=0.01). On subset analysis, after excluding patients who never met an indication for surgical intervention (n=145), there was no difference in survival between groups (82.9% vs. 84.3%, p=0.86). On multivariate analysis, after adjusting for age, injury severity, and type of lesion, compliance was not associated with improved survival to discharge (OR=2.92, 95% C.I.=0.89-9.60, p=0.77).

Conclusion: Compliance with the BTF surgical management guidelines was not associated with improved survival in this single-institutional retrospective analysis. Larger, adequately powered, multi-institutional studies are required to determine the effect of compliance with these guidelines on meaningful patient outcomes including mortality and neurologic functional recovery.

Poster # 40

USEFUL OR USELESS? PLATLET FUNCTION TESTING AFTER TRAUMATIC INTRACRANIAL HEMORRHAGE

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Introduction: As the elderly population continues to increase anti platelet therapy (APT) has become increasingly common. The impact of routine platelet transfusion in patients on APT after Traumatic Intracranial Hemorrhage (tICH) is a questionable practice. Recently platelet function testing (PFA) has become widely available. We sought to examine the impact of PFA-100 testing on admission platelet utilization and clinical outcomes after tICH.

Methods: This was a retrospective review of patients admitted to a Level I trauma center with a documented blunt tICH and available PFA-100 data over the past 3 years. Demographic, physiologic, and outcomes data were collected and stratified according to PFA-100 results. The discriminatory ability of an abnormal PFA (aPFA) to predict worsening tICH (interval radiographic change in tICH) was calculated using sensitivity and specificity. Logistic Regression modeling was used to determine adjusted odds ratios (AOR) for platelet transfusion based on aPFA. AOR for worsening tICH, craniotomy, decrease in discharge Glasgow Coma Score (GCS), and in-hospital mortality based upon admission PFA were also calculated.

Results: During the 3 year study period 712 patients were analyzed with 29% having aPFA. Patients with aPFA were more likely to be older, suffer from falls, have a higher Charlson score, and pre-existing APT than those with normal PFA. Median head AIS (3) was similar while those with normal PFA having a slightly decreased admission GCS (14 vs. 15,p <0.001). Isolated Head Injuries were more common in the aPFA (82% vs 67%,p <0.001) injury burden was greater in those with normal PFA (ISS>25,19% vs. 9%,p=0.001). aPFA was 28% sensitive and 70% specific in predicting worsening tICH. aPFA was associated with increased platelet transfusion (62% vs. 13%,AOR 9.4p <0.001). Despite the increased platelet utilization in those with aPFA, the incidence of worsening tICH (59% vs. 61%, p=0.166),decrease in discharge GCS (17% vs 16%,p =0.133), and in-hospital mortality (5% vs 7%,p =0.971) were not significantly different. Need for craniotomy was lower in aPFA (14% vs. 17%,AOR 0.45 p=0.015)

Conclusion: aPFA is common after tICH and is a poor discriminator in determining evolution of tICH. aPFA is associated with liberal admission platelet transfusion without improved outcomes. Transfusion of platelets based solely on aPFA should be carefully considered while further prospective analysis examining the utility of PFA testing after tICH is undertaken.

Poster # 41

THE RISK OF NEUROSURGERY AND MORTALITY IN A POPULATION WITH MILD TRAUMATIC BRAIN INJURY AND INTRACRANIAL HEMORRHAGE: A THREE-YEAR MULTI-CENTER RETROSPECTIVE OBSERVATIONAL STUDY

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Introduction: In recent years, it has been proposed to re-evaluate which patients with mild traumatic brain injuries (mTBI, GCS 13-15) and intracranial hemorrhage (ICH) should be transferred from a hospital without neurosurgical coverage, to a hospital with neurosurgical coverage. The purpose of this study was to describe in detail the neurosurgical intervention and mortality rates associated with mTBI and ICH with the hopes of identifying which patients should be considered to forgo inter-hospital transfer. **Methods**: This was a three-year, retrospective, multicenter observational cohort study at two Level I, and one Level II Trauma Centers. All consecutively admitted adult (≥18 years) trauma patients with mTBI and ICH were included in the study (GCS 13-15 and ICD9 851.0–853.19). Patients with skull fractures were excluded; ICH type cannot be determined from skull fracture-related ICD9 codes (n=484); "unspecified" hemorrhage types were also excluded (n=54). The primary outcome measure was neurosurgery (craniotomy, burr holes, ICP placement, shunt, ventriculostomy, subdural hemorrhage evacuation), and the secondary outcome was in-hospital mortality. **Results**: There were a total of 1,527 patients included in our study. A majority of the injuries resulted from falls (66%), 39% had a severe head injury according to a head AIS (4-6), and a majority had an isolated head injury (78%) with one hemorrhage (68%). The top three most common ICH types were isolated subdural hematoma (iSDH) (32%), isolated traumatic subarachnoid hemorrhage (itSAH) (27%) and multiple ICHs (32%).There were significant differences in the neurosurgical intervention and mortality rates between ICH types (Table 1). **Conclusion**: A large majority (74%) of all neurosurgeries in this population were in patients with iSDH. iEDHs had the second highest neurosurgical rate and the highest mortality rate. More importantly, the extremely rare requirement of neurosurgical intervention in patients with mild itSAH (1 in 400) should give clinicians a moment of pause before deciding to transfer these types of patients to a higher-level Trauma Center.

Table 1. Comparing Primary and Secondary Outcomes Between ICH Types

ICH Type	Neurosurgery Events (N_1/N_0)	Neurosurgery Rate[1]	Mortality Events (N_1/N_0)	Mortality Rate[2]
Isolated Subdural	80/403	16.6%	14/469	2.9%
Isolated Epidural	1/10	9.1%	1/10	9.1%
Multiple Hemorrhages	24/465	4.9%	22/467	4.5%
Isolated Contusion	2/126	1.6%	0/128	0.0%
Isolated Subarachnoid	1/415	0.2%	5/411	1.2%

[1] $p<0.001$ between ICH types; [2] $p=0.01$ between ICH types

Poster # 42

DEXMEDETOMIDINE IS A SAFE AND EFFECTIVE ADJUNCTIVE AGENT FOR SEDATION IN PATIENTS WITH TRAUMATIC BRAIN INJURY

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Introduction: In patients with traumatic brain injury (TBI), optimizing sedation is challenging since maintaining a clinical exam is of paramount importance in being able to detect neurological deterioration. Additionally, optimizing intracranial pressure (ICP) and cerebral perfusion pressure (CPP) is crucial in TBI. Propofol is frequently used as a sedative in TBI since it has been shown to reduce the cerebral metabolic rate, but may lead to propofol-related infusion syndrome and hemodynamic compromise. Dexmedetomidine is a sedative that produces minimal respiratory depression and has opioid-sparing effects. We hypothesized that use of dexmedetomidine (DEX) would be a useful and safe adjunct for sedation of critically ill patients with TBI.

Methods: This prospective observational single-center study was conducted from December 2011 through June 2013. Inclusion criteria were: TBI with a head abbreviated injury scale (AIS) score > 2, mechanical ventilation > 24 hours, and continuous infusions of propofol (PROP) and/or dexmedetomidine (DEX). Sedative agents were titrated using the Richmond Agitation Sedation Scale (RASS) while maintaining ICP < 20 mm Hg and CPP > 60 mm Hg. Mean daily number of hours in target RASS (0-alert and calm to -2-light sedation) were analyzed stratified by sedation agent using adjusted mixed regression models to account for variability of measurements in patients and control for baseline injury characteristics.

Results: One hundred ninety-eight patients were enrolled. Mean age was 40.6 ± 18.0 while median values (with interquartile ranges) for head AIS were 4 (4-5), admission GCS 7 (3-11), and ISS 34 (25-43). The mortality rate was 6.7%. Patients had a median hospital length of stay (LOS) of 16 (12-23) days with the majority of their stay spent in the ICU (14 days [9-21]). Patient-days (1028 in total) were stratified into 4 groups: DEX Only (n = 222), DEX + PROP (n = 148), PROP Only (n = 599), and Neither (n = 59). ICP control was no different among the 4 groups. Regression analyses indicated a significant difference in target RASS between sedation agents ($p<0.001$). The DEX Only group had the highest mean daily estimate of 17.7 hours. Pairwise comparisons between sedative agents demonstrated that the DEX Only group spent more time in target RASS than DEX + PROP (15.7 hours, $p=0.046$), PROP Only (12.3, $p<0.001$) and Neither (12.9, $p=0.002$). In a subset of patients for whom complication data was available, the occurrence rates of complications such as hypertension, hypotension, bradycardia, and tachycardia were not significantly different between the sedation groups (DEX, PROP, DEX + PROP).

Conclusion: Administration of sedatives is integral in optimizing patient comfort and minimizing distress in critically ill patients. In patients with TBI, this is particularly important to minimize secondary insults while maintaining the ability to monitor the patients' neurological exam. Dexmedetomidine is a safe and useful sedative in patients with TBI allowing for effective sedation while minimizing secondary injury.

Poster # 43

COMORBIDITIES AND OUTCOMES AT SIX MONTHS FOLLOWING A TRAUMATIC INJURY

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Introduction: The impact of comorbidity on the functional and psychological outcomes of patients exposed to traumatic injury has not been fully investigated. Increasingly, negative psychological consequences of trauma are being recognized and measures put in place to identify patients most at risk. Determining if pre-injury comorbidity contributes to longitudinal outcomes is an important step in this process.

Methods: This cohort is part of a larger prospective longitudinal study consisting of individuals ≥18 years of age admitted to the trauma service of a Level I trauma center for ≥ 24 hours. Outcomes were measured at baseline (hospitalization) and at 6 months post-injury and included: depression, posttraumatic stress disorder (PTSD), health related quality of life, and pain level. Depression was measured using the Patient Health Questionnaire (PHQ-8), PTSD with the Primary Care PTSD Screen (PC-PTSD), health related quality of life with the Veterans RAND 12-item Health Survey (VR-12), and pain level with the Numeric Rating Scale (NRS). Demographics, comorbidities, and injury-related variables were collected from the trauma registry. Pearson correlations and linear regression models were performed for analysis.

Results: 261 patients were included in this analysis. Number of comorbidities (≥3) was significantly correlated to poor physical health quality of life ($p = 0.001$), poor mental health quality of life ($p = 0.021$), depression ($p < 0.001$), PTSD symptoms ($p = 0.018$), and higher pain levels ($p = 0.002$) at 6 months. Smoking was significantly correlated to poor physical health quality of life ($p = 0.032$), poor mental health quality of life ($p=0.036$), depression ($p = 0.010$), and PTSD ($p < 0.001$) at 6 months. Diabetes was significantly correlated to poor physical health quality of life ($p = 0.016$), depression ($p = 0.012$), and higher pain levels ($p = 0.004$). Injury Severity Score (ISS) was not correlated with any outcomes at 6 months post injury.

Conclusions: Having three or more medical comorbidities present upon admission has a substantial negative impact on both psychological and functional outcomes in the six months following injury. Additionally, smoking and diabetes emerged as having important associations with later outcome. Interestingly, these findings appear to be independent of Injury Severity Score, suggesting that pre-existing comorbidities may have an important contribution when considering long term outcome in the trauma population.

Poster # 44

REPEAT HEAD COMPUTED TOMOGRAPHY IS NOT NECESSARY FOR PATIENTS ON ANTICOAGULATION OR ANTIPLATELET THERAPY WHO SUFFER LOW ALTITUDE FALLS

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Introduction: Anticoagulation and antiplatelet (ACAP) medications are frequently prescribed to elderly patients who are at high risk for falls. Many trauma centers have developed protocols for obtaining repeat head computed tomography (HCT) for patients with low impact falls on ACAP therapy. We hypothesize that obtaining a routine scheduled repeat HCT after an initial negative HCT for ACAP therapy patients after low altitude falls is not necessary.

Methods: Retrospective review of all low altitude fall (< 6 feet) patients on ACAP therapy evaluated at a Level II, community hospital from 2013 - 2014. All patients who suffered a low altitude fall with visible or suspected head trauma had an initial HCT (HCT1). Patients were then admitted and a repeat HCT (HCT2) was obtained 12 hours from HCT1, or earlier if there was acute neurologic decline. Exclusion criteria included all patients < 18 years old and those who did not undergo a HCT2. Chi-square, Fischer exact, t-test and Wilcoxon rank-sum tests were used for our analysis. Statistical significance is set at $p<0.05$.

Results: Total of 1503 patients were enrolled with a low altitude fall and HCT1. 1382 (92%) were negative for intracranial hemorrhage (ICH) and 121 (8%) patients had a positive HCT1. Average age was 79.9±11.4 years, 61% were female and 85% had visible head trauma on initial presentation. 199 were excluded because they did not receive a HCT2 based on established protocols. Of the patients with positive HCT1 patients, only 11 (1%) required surgical intervention. Of the 1304 patients with a negative HCT1 who underwent HCT2, 11 (1%) had delayed ICH at the repeat HCT. None of these 11 patients required surgery, required major changes in their clinical management or suffered mortality. 70% of the patients were taking low or high strength aspirin (ASA), 19% were taking Coumadin, 17% were taking Plavix, 3% were on Xarelto, and 2% were on other anticoagulants. 73% of patients with a positive HCT1 were taking ASA, ($p=0.33$). Patients on Coumadin accounted for 27% of positive HCT1, ($p=0.016$). 93% of all positive HCTs were among patients >65 years of age, however, 88% of all negative HCT's were also in this same age group therefore this was not statistically significant ($p=0.096$).

Conclusion: Repeat HCT for patients on any ACAP therapy after a low altitude fall with a negative initial HCT is not necessary and only adds cost, radiation exposure and additional anxiety for the patient. Because our incidence of delayed bleeds was so low and did not affect overall outcomes, we feel thorough neurologic examination and close monitoring is as effective as obtaining a repeat HCT.

Poster # 45

IMPROVING LIFE EXPECTANCY: "A BROKEN NECK" DOESN'T HAVE TO BE A TERMINAL DIAGNOSIS FOR THE ELDERLY

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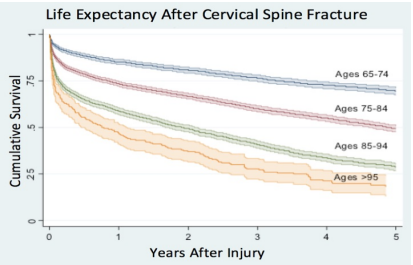
Introduction: Optimal treatment for elderly patients with cervical spine fractures is critical for preserving quality of life. Many elderly patients are kept in a cervical collar or halo, which may significantly limit mobility, exacerbate dysphagia and contribute to airway compromise; potentially increasing morbidity and mortality. This investigation intends to describe the life expectancy after such an event, and evaluate the impact of surgical intervention on post injury mortality.

Methods: Patients 65 years or older with traumatic cervical spine fracture ICD-9 codes were identified in the California Office of Statewide Health and Planning database for the years 1995-2009. Patients with cervical spinal cord injury were excluded. Interventions analyzed were halo use and surgical spine fixation. Patient factors studied included demographics, Charlson comorbidity, Survival Risk Ratio, mechanism of injury, associated injuries, complications (pneumonia, venous thromboembolism and myocardial infarction) and trauma center admission. Primary outcome was death, studied at the initial admission, 30 days, 1 year, and at any time during the study period. Analyses included univariate, bivariate, logistic and cox regressions, and Kaplan-Meier survival curves.

Results: 10,938 patients were identified. Mortality rate was 10% during the initial admission, 28% at 1 year and 50% over the entire study period. A halo was placed in 14% of patients and 12% underwent surgical fixation. During the initial admission, patients without an intervention had a mortality rate of 11%, with halo placement 7% and 6% with surgical fixation; at 1 year mortality rates increased to 30%, 26% and 19%, respectively. A complication occurred during the initial admission in 19% of patients with an associated mortality rate of 22%.

On multivariate analysis cervical spine fixation, female gender and admission to a trauma center were independent predictors of a lower risk of death at 1 year (OR 0.59, 0.68 $p<0.001$, and OR 0.89, $p=0.02$ respectively). Having a complication, fall mechanism, presence of traumatic brain injury (OR 1.84, 1.33, 1.37 $p<0.001$ respectively), and increasing age (Figure) were independent predictors of a higher risk of death at 1 year. Halo use had no impact on death at 1 year (OR 0.98,$p=0.768$).

Conclusions: Mortality rate after cervical spine fracture in the elderly is high. At one-year post injury more than 1 in 4 patients over the age of 75 will die. Surgical spine fixation is associated with a significant improvement in the odds of survival following cervical spine fracture. This remained true after adjusting for age, comorbidities, and complications; suggesting that surgical fixation may improve outcomes in the elderly.



Poster # 46

INTERPRETING THE TQIP "WITHDRAWAL OF CARE" BENCHMARK: WHERE DO WE REALLY STAND?

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Carolinas Medical Center

Background: ACS-TQIP provides an opportunity for participating trauma centers to benchmark various outcomes against national averages. According to the September 2014 TQIP Benchmark Report, a much higher percentage of our institution's trauma deaths resulted from withdrawal of care, compared to the national average (53.5 vs 37.1%). We reviewed our TQIP deaths to determine the reasons for, and appropriateness of, the decision to withdraw care in our trauma patient population.

Methods: Retrospective chart review of all TQIP trauma deaths occurring at our institution between January 2013 and March 2014, with a specific focus on process improvement (PI) data contained within our trauma registry. Outcomes were classified according to standard ACS-PI criteria for opportunities for improvement (OFI), and overall quality of care. Standard statistical analyses were applied with statistical significance established at $p \leq 0.05$.

Results: 172 TQIP trauma deaths occurred during the period studied, 92 of which followed withdrawal of care (53.5%). Rationale provided for withdrawal included "non-survivable injuries" in 52.4% of patients, and "futility" in 47.6%. Mean ISS for withdrawal patients was 26.7, and 57.6% had a Head-AIS = 5. Compared to "non-withdrawal" deaths, withdrawal patients were older (61.2 years vs 50.7 years; $p = 0.007$) and white (72.3% vs 50.6%; $p = 0.022$). Care was withdrawn at a median of 2.5 days following admission, but overall hospital LOS did not differ between withdrawal and non-withdrawal patients. 80 patients (87%) had complete OFI and quality of care judgments recorded in the trauma registry. Opportunities for improvement in care were identified in only 16 patients (20%), including 2 patients where resuscitative efforts were judged to have been prolonged in the face of futility. None of the other 14 OFI's were felt to have contributed to the patient's death. Overall quality of care was judged to be "acceptable" in 71 patients (88.8%), "acceptable with reservations" in 8 patients (10%), and "unacceptable" in only 1 patient (1.25%). 13 withdrawal death patients (15.1%) subsequently became organ donors.

Conclusion: Although admittedly subjective, decision-making regarding withdrawal of care in our severely injured trauma patients appears to have been appropriate, based upon rigorous PI review. Although retrospective, our data suggest that institutions with higher withdrawal rates, as opposed to "giving up too early", may be better at recognizing futility at an earlier stage, leading to earlier termination of costly resuscitation, while still preserving opportunities for organ donation.

Poster # 47

THORACIC PAIN MANAGEMENT PROTOCOL AND RESPIRATORY THERAPIST SPECIALIZATION: IMPROVING PATIENT OUTCOMES THROUGH STANDARDIZED PULMONARY PRACTICES

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Introduction: We previously showed that trauma ICU readmission (RA) most often occurs due to respiratory compromise and undertook this study to prospectively assess ICU RA and outcomes following modification of trauma service pulmonary hygiene practices at our Level I Trauma Center.
Methods: We performed a retrospective chart review of trauma service ICU RA from 2004-2008 (PRE). Upon discovering that most ICU RA occurred as the result of pulmonary compromise, a thoracic pain management protocol and unit specialization of respiratory therapists were implemented. Prospective assessment of ICU RA from 2009-2013 (POST) was then conducted. Demographics, injuries and injury severity, reason for transfer, LOS, interventions, and outcomes data were collected.
Results: Overall, there were 5698 PRE and 6582 POST ICU admissions with initial ICU admission mortality rates of 13.5% and 9.8%, respectively. Of patients discharged from the ICU, RA rates were 3.2% PRE and 4.7% POST. Pulmonary reasons for ICU RA decreased from 48.1% PRE to 39.4% POST while neurological reasons for readmission increased from 12.7% PRE to 19.5% POST. Of note, ICU LOS, HLOS, and mortality all significantly decreased following modification of pulmonary practices (table).

PRE vs. POST Pulmonary Interventions (*p<0.05)

	1st ICU LOS	Floor Days Prior to ICU RA	2nd ICU LOS	HLOS	ICULOS	Mortality
PRE	6.6 ±8.0	5.7 ±6.3	8.0 ±8.5	32.3 ±25.9	13.8 ±11.9	14.0%
POST	5.9 ±6.8*	4.7 ±7.0*	4.9 ±5.6*	27.0 ±22.1*	11.5 ±9.2*	11.9%

Conclusion: While the overall rate of ICU RA increased, the implementation of a thoracic pain management guideline and respiratory therapy specialization decreased pulmonary ICU RA and ultimately yielded improved patient outcomes with significantly decreased ICU LOS, HLOS, and mortality.

Poster # 48

WHERE WE FAIL: THE LOCATION OF FAILURE TO RESCUE IN TRAUMA PATIENTS

Jennifer Chung MD, Emily Earl-Royal BS, Mucio K. Delgado MD, Patrick M. Reilly* MD, Carrie A. Sims* MD, MS, Jose L. Pascual* MD,Ph.D., Dougl Wiebe Daniel Holena
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Introduction:

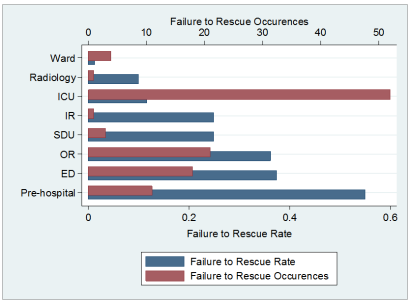
Failure to Rescue (FTR) is an outcome metric which reflects a center's ability to prevent mortality once a major complication has occurred. Efforts to reduce FTR rates should be informed by the timing and location of FTR occurrences, but these have not been described in previous FTR studies in the trauma population. We sought to characterize the timing and location of FTR occurrences at our center with the hypothesis that FTR rates would be highest early after injury and in settings of lower intensity of care.

Methods:

Prospectively collected data from 2009-2013 from a single institution were used. Patients age >16 years with minimum Abbreviated Injury Score ≥ 2 were included; outside hospital transfers were excluded. Baseline patient data, location and timing of the first major complication (defined according to Pennsylvania Trauma Systems Foundation definitions and including adult respiratory distress syndrome, acute respiratory failure, aspiration pneumonia, atelectasis, myocardial infarction, pneumonia, pulmonary embolism, deep venous thrombosis, arrhythmia, coagulopathy, pleural effusion, hypothermia, postoperative hemorrhage, cardiopulmonary arrest, adverse drug reaction, acute kidney injury, hepatic failure, stroke, empyema, sepsis, septicemia, esophageal intubation, gastrointestinal bleeding, organ/nerve/vessel injury, decubitus ulcer, urinary tract infection, or wound infection) were abstracted. Major complications, mortality, and FTR rates were calculated and examined by location (Pre-hospital, Emergency Department, Operating Room, Step Down Unit, Interventional Radiology, Intensive Care Unit, Radiology, or Ward) and by day post admission. Kruskal-Wallis and chi squared tests were used to compare variables with statistical significance set at p =0.05).

Results:

Major complications occurred in 899/6150 (14.6%) of included patients (median age 42 (IQR 25-57), 56% African American, 73% male, 76% blunt, median ISS 10(IQR5-17)). Death occurred in 111/899, for an FTR rate of 12.4%. Compared to non-FTR cases, FTR cases had earlier major complications (median day 1 (IQR0-4) vs. 5 (IQR2-8), p<0.001). FTR rates were highest in the pre-hospital (55%), the ED (38%), and the OR (36%) settings (Figure), but the greatest number of FTR cases occurred as a result of a major complication in the ICU (52/111, 47%).



Conclusions: Failure to rescue rates are highest early after injury, but the majority of cases occur in the ICU. Efforts to reduce institutional FTR rates should focus on major complications that occur in the ICU setting.

Poster # 49

RESILIENCY AND QUALITY OF LIFE TRAJECTORIES AFTER INJURY

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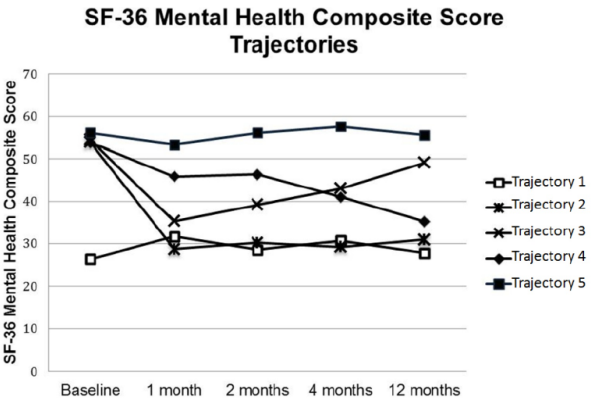
Introduction: Traumatic injury has been shown to greatly impact patients' long-term quality of life. Resilience refers to an individual's ability to positively adapt after facing stress or trauma. The objective of this study was to examine the relationship between pre-injury resiliency scores and quality of life after injury.

Methods: 225 adults admitted with an Injury Severity Score > 10 but without neurological injury were included in the study. A quality of life survey (SF-36) was administered at the time of admission and repeated at 1, 2, 4 and 12 months after injury. The Connor-Davidson Resilience Scale survey was also completed by patients at admission and scores were categorized into low, average, or high resiliency. Group based trajectory modeling (GBTM) was used to identify distinct recovery trajectories for physical component scores (PCS) and mental component scores (MCS) of the SF-36. Multinomial logistic regression was used to determine whether baseline resiliency scores were predictive of PCS and MCS recovery trajectories.

Results: There were 3 PCS and 5 MCS trajectories identified by GBTM (Figure).



Relative to the high resiliency group, patients in the low resiliency group were more likely to belong in trajectories with the lowest (trajectory 1= 10.7%) and second lowest (trajectory 2 = 14.7%) mental health scores over the course of recovery (OR 13.32 [CI 1.70-104.36] and OR 7.07 [CI 1.34-37.22], respectively). Patients with average resilience scores were also more likely than patients with high resilience scores to belong to the trajectory with the lowest mental health scores (OR 6.22 [1.51-25.54]). Resiliency scores did not significantly predict recovery trajectories of physical health.

Conclusion: Patient resiliency predicts quality of life after injury in regards to mental health with over 25% of patients suffering poor mental health outcome trajectories. However, there is no association between resiliancy and physical recovery trajectories. Efforts to teach resiliency skills to injured patients could improve long-term mental health for injured patients. Trauma centers are well positioned to carry out such interventions.

Poster # 50

CLOT AMPLITUDE MEASUREMENT AT 10 MINUTES PREDICTS MASSIVE TRANSFUSION AND 24H MORTALITY

Precilla V. Veigas Ph.D., PhD (C), Jeannie Callum Sr., MD, St. Michael's Hospital, Toronto

Introduction:Coagulopathy occurs in ¼ of all severely injured patients, and significantly reduces survival. Hemorrhage is the most preventable cause of traumatic death, which occurs early. The use of viscoelastic assays (ROTEM) is increasing to diagnose coagulation defects and guide their treatment. However, to have a role in the resuscitation of bleeding coagulopathic patients, the assay must provide early and clinically useful results. We hypothesize that the ROTEM clot amplitude measured at 10 minutes of initiating the test (A10 EXTEM) is a predictor of both the need for massive transfusion (MT) and 24h mortality and may have a role in resuscitation of bleeding coagulopathic patients.

Methods:Retrospective analysis of all adult trauma patients (blunt and penetrating but excluding burns, drowning and hanging) admitted to a Level I trauma center between Aug 2011 and Mar 2013. Important clinical, laboratory and ROTEM variables available at admission were analysed. Univariate and multivariable logistic regression analyses were used to identify independent predictors of MT (≥10U red blood cells in 24h) and 24h mortality. Model performance was assessed.

Results:1146 patients were included, 22 (2%) received MT and 29 (3%) died within 24h. Median age was 41 (IQR 26-58) and 73% were men. MT and 24h mortality patients had more severe injuries, abnormal laboratory and ROTEM assays ($p<0.05$ for all variables) compared to non-MT and patients surviving over 24h. Unadjusted univariate analysis reported all variables ($p<0.2$) except gender (MT: $p=0.874$; 24h mortality: $p= 0.433$) as predictors of MT and 24h mortality. Variables independently associated with MT in multivariable logistic regression were: age (OR 0.966 95% CI: 0.939-0.994 $p=0.0163$); ISS (OR 1.062 95% CI: 1.024-1.101 $p=0.001$); SBP (OR 0.974 95% CI: 0.960-0.988 $p=0.0005$); HG (OR 0.973 95% CI: 0.950-0.995 $p=0.019$); and A10 EXTEM (OR 0.942 95% CI: 0.906-0.980 $p=0.003$). The C statistic for the model was 0.965 and Hosmer-Lemeshow-goodness-of-fit was 0.927. Variables independently associated with 24h mortality in multivariable logistic regression were: age (OR 1.022, 95% CI 1.002-1.042, $p=0.030$); ISS (OR 1.063, 95% CI: 1.029-1.099, $p=0.0003$); and A10 EXTEM (OR 0.896, 95% CI 0.859–0.935, $p<0.0001$). The C statistic was 0.846 and Hosmer-Lemeshow-goodness-of-fit was 0.115.

Conclusion:In 10 minutes from starting the test (ROTEM), the measurement of the clot amplitude (A10 EXTEM) is capable of predicting both the need for massive transfusion and mortality. While these findings require prospective validation, they indicate that an abnormal A10 EXTEM result may be clinically relevant and useful to the clinical decision-making process during early resuscitation.

Poster # 51

REDUCING ACUTE KIDNEY INJURY DUE TO VANCOMYCIN IN TRAUMA PATIENTS

Andrea A. Zaw MD, Ara Ko MD, Jason Murry MD, David Hoang MD, Beatrice Sun BS, Jessica Jay BS, Tong Li BS, Bansuri Patel BS, Russell Mason pharm D, Eric J. Ley* MD, Cedars-Sinai Medical Center

Introduction: Supratherapeutic vancomycin trough levels are common after trauma and associated with both increased acute kidney injury (AKI) and mortality. We sought to limit the adverse effects of vancomycin in trauma patients through more frequent trough monitoring.

Methods: Starting January 2011 trauma patients had daily vancomycin trough levels until steady-state was reached. Trauma patients admitted January 2006 to December 2010 (PRE) were compared to those admitted from January 2011 to August 2014 (POST). Inclusion criteria required administration of intravenous vancomycin, admission serum creatinine, and serum creatinine measured within 72 hours of the highest vancomycin trough. AKI was defined as an increase in serum creatinine of at least 0.5 mg/dL or 50% from admission to post-vancomycin administration.

Results: 263 patients met inclusion criteria in PRE, compared to 206 in POST. There were no statistically significant differences between the two groups for age, gender, admission SBP, ISS, GCS and ICU LOS. Rate of vancomycin trough > 20 trended higher in the PRE cohort compared to POST (35% v. 27%, p=0.06). Overall, AKI rate was higher during PRE compared to POST (37% v. 17%, p<0.01). High rates of AKI were noted in both cohorts with vancomycin trough > 20 although a reduction was observed during POST (56% v. 36%, p=0.02). Mortality was similar between two groups (10% PRE v. 10% POST, p=0.83).

Conclusion: A reduction in AKI was observed in trauma patients with daily vancomycin trough levels until steady-state. Increased awareness regarding vancomycin dosing and closer surveillance of serum creatinine levels in trauma patients may limit the incidence of related kidney injury.

Demographic data	PRE n=263	POST n=206	P value
Age, y (mean ± SD)	50 ± 22.6	48 ± 20.8	0.52
Male (%)	212 (81%)	157 (76%)	0.22
Admission SBP, mmHg (mean ± SD)	136.7 ± 35.6	134.8 ± 30.6	0.59
Admission GCS (mean ± SD)	11.0 ± 4.6	11.0 ± 4.6	1.00
ISS (mean ± SD)	20.2 ± 12.7	21.8 ± 13.1	0.16
Head AIS (mean ± SD)	2.3 ± 2.0	2.4 ± 2.0	0.59
ICU LOS (mean ± SD)	13.6 ± 11.5	11.8 ± 11.1	0.19
VT (mean ± SD)	17.5 ± 9.2	16.6 ± 11.2	0.34
Vanco trough > 20	91 (35%)	55 (27%)	0.06
pre-dose Cr (mean ± SD)	0.8 ± 0.5	0.8 ± 0.3	1.00
post-dose Cr (mean ± SD)	1.2 ± 1.3	1.0 ± 0.6	0.046
AKI (%)	97 (37%)	36 (17%)	<0.0001
AKI vanco trough > 20 (%)	51 (56%)	20 (36%)	0.02
Mortality	25 (10%)	21 (10%)	0.83

Poster # 52

GERIATRIC TRAUMA: MULTIDISCIPLINARY APPROACH TO IMPROVE MORTALITY AND DISPOSITION

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BACKGROUND: Advanced age is a well-recognized risk factor for adverse outcome after trauma. The etiology of this outcome difference is debated but may be due preexisting conditions or decrease physiologic reserve. Due to the increasing life expectancy there is an increase in the number of older more mobile individuals. Compared with younger cohorts, elderly trauma patients have higher admission rates, increased HLOS, long-term morbidity and mortality rates despite lower ISS. This results in a disproportionate higher percentage of resources expended on the care of the injured elder patient. Our objective is to determine whether incorporation of a geriatric consult (GC) had a beneficial effect in reducing in hospital mortality and expedient disposition.

METHODS: Retrospective data from an integrated data repository was queried 1.7 years prior and 1.3 years following the start of a GC. Consults were obtained for patients age ≥ 65 with multiple comorbidities admitted to the trauma service. Primary outcomes included HLOS, in hospital mortality and disposition (home, home with healthcare (HH), skilled nursing facility (SNF), and rehab unit). Secondary outcome examined follow-up after discharge.

	Pre	Post	p-value
LOS (d)	8.2	9.6	0.0479
Mortality (%)	13	6	<0.001
Home (%)	44	33	<0.001
HH (%)	11	18	<0.001
SNF (%)	30	43	<0.001

RESULTS: Over 3 years, 1059 patients age ≥ 65 were admitted to the trauma service. In hospital mortality was reduced (13.3 to 5.87, $p<0.001$). Patients were less likely to be discharged home, although there was an increased use of home health care (44.4 to 33.7%, $p<0.001$, 11.8 to 17.7%, $p<0.001$). An increase in those continuing to intermediate care facilities was also noted (30.5 to 42.9%, $p<0.001$). A 7-fold increase was noted in follow-up appointments. There were no significant differences in gender, age between groups or HLOS.

DISCUSSION: Major benefits derived from a specialized geriatric assessment following trauma include a striking reduction in mortality by approximately half. Additionally more patients returned home with HH after the GC. There was an expected increase in discharges to SNF and rehab facilities. This data suggests implementing a GC improves the outcome of trauma geriatric patients, with overall better utilization of healthcare.

Poster # 53

THE RELATIONSHIP BETWEEN PROCESSES AND OUTCOMES FOR INJURED OLDER ADULTS: A STUDY OF A STATEWIDE TRAUMA SYSTEM

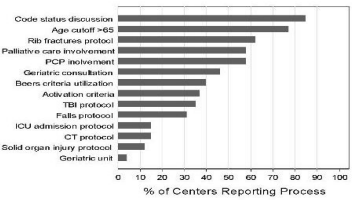
Noelle N. Saillant* MD, Emily Earl-Royal BS, Jose L. Pascual* MD,Ph.D., Steven R. Allen* MD, Patrick K. Kim* MD, M K. Delgado MD, MS, Brendan G Carr G. Carr MD, MSPH, Doug Weibe Ph.D., Daniel N. Holena* MD, University of Pennsylvania

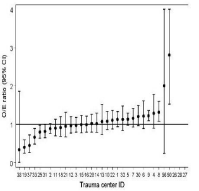
Introduction: Age is an independent risk factor for death, adverse outcomes, and disproportionate health care use following traumatic injury. Literature has suggested that system based modifications may improve geriatric trauma outcomes. The American College of Surgeons' Trauma Quality Improvement Program (TQIP) has published evidence on "best practices" of geriatric trauma care, but adoption of these guidelines is unknown.We sought to determine which evidence-based geriatric protocols, including TQIP guidelines, were correlated with decreased mortality in Pennsylvania's trauma centers.

Methods:We surveyed Pennsylvania's level I and II trauma centers to assess adoption of evidence-based geriatric protocols. Survey data was merged with risk-adjusted mortality data for patients ≥ 65 years from a statewide database, the Pennsylvania Trauma Systems Foundation (PTSF), to ascertain associations between mortality outlier status and processes of care. The exposures of interest were the center-specific processes of care, as identified via survey. The outcome of interest was PTSF mortality outlier status (low, average, or high).

Results:26 of the 27 eligible trauma centers participated. There was wide variation in processes of care. Four trauma centers were low outliers and three centers were high outliers for risk-adjusted mortality rates in adults ≥ 65. Results remained consistent when accounting for center volume. The only process associated with mortality outlier status was age-specific solid organ injury protocols (p=0.04). There was no cumulative effect of multiple evidence-based processes on mortality rate (p=0.50).

Conclusion:We did not see a link between adoption of geriatric best-practices trauma guidelines and reduced mortality at PA trauma centers. The increased susceptibility of elderly to adverse consequences of injury combined with the rapid growth rate of the elderly population emphasizes the importance of identifying interventions to improve care quality and distribution to this population.





Poster # 54

D-DIMER AS A SCREENING TOOL FOR DEEP VENOUS THROMBOSIS IN THE TRAUMA PATIENT

Gail T. Tominaga* MD, Imad S. Dandan* MD, Fady S. Nasrallah MD, Kathryn B. Schaffer MPH, Jess Kraus Ph.D., Anthony R. Chiatello BSN, James G. Schwendig MD, Marc Sedwitz MD, Scripps Memorial Hospital La Jolla

Introduction: Routine venous duplex ultrasound (VDUS) screening for deep venous thrombosis (DVT) has been proposed, although no standards have been established. A study of VDUS screening practices in trauma centers (TC) found wide differences in practices. To decrease the use of routine VDUS screening in all hospitalized trauma patients (pts), we proposed the use of D-dimer on admission to determine whether VDUS could be avoided.

Methods: All trauma pts admitted to one level II TC had a D-dimer performed on admission. All pts had VDUS performed unless hospitalized less than 48 hours. Weekly VDUS were performed in those pts with below knee thrombus or high-risk patients. We reviewed our experience to see if D-dimer values could be used to identify a subset of trauma pts who did not need routine VDUS. Pts admitted from 8/2013 through 12/2014 were included. The trauma surgeon assessed the risk for DVT. High risk characteristics are pelvic, femur or vertebral body fractures, spinal cord injury, head AIS $\geq$ 4, hypercoagulable state, family history of venous thromboembolism, pregnancy, hormone therapy or birth control use. Hamilton scores were calculated on admission. Admission risk assessment was classified as high risk in pts with any high risk characteristics and/or Hamilton score > 2; moderate risk in pts with Hamilton score of 2 and/or obese pts; low risk in pts with no high risk characteristics and Hamilton score of 1 or less. D-dimers levels greater than 551 were classified as abnormal. Hospital charge for D-dimer assay is $88.90 and for VDUS $1006. Trauma registry and medical records were reviewed for demographic data, D-dimer values, DVT, and mortality.

Results: 2336 trauma pts were evaluated with 1912 pts meeting study criteria. There were 67% males with mean age 50.2 yrs, mean ISS 9.8, mean length of stay 4.8 days, and 58 deaths (3%). Pts were stratified by risk and D-dimer results (see Table).

RISK	Low		Moderate/High		Total
	DVT	No. of pts	DVT	No. of pts	DVT/Total pts
D-dimer normal	1	297	3	84	4/381 (1.05%)
D-dimer abnormal	13	738	28	793	41/1531 (2.68%)
DVT/Total pts	14/1035	(1.35%)	31/877	(3.53%)	

The negative predictive value for D-dimer was 99.0% and for our risk stratification was 98.6%. If all pts with normal D-dimers did not undergo VDUS, we could have avoided $949,198.50 in charges.

Conclusion: Admission D-dimer may be a cost effective way to avoid unnecessary VDUS in trauma pts with negative assay results who are admitted to the hospital. If all trauma pts with normal D-dimers did not undergo VDUS, we could have avoided $949,198.50 in charges. Observed risk assessment performed after initial resuscitation phase was inconsistent as some disease processes and injuries were determined later during the hospital course. Future protocols should include risk assessment after a tertiary survey has been completed.

Poster # 55

TOWARD A DEEPER UNDERSTANDING OF SURGICAL MORTALITY

Larry C. C. Martin* MD, Thomas Helling* MD, Magdeline Martin RN, William Cauthen MD, Marc Mitchell MD, University of Mississippi Medical Center

Introduction:Surgical mortality traditionally includes patients undergoing an operation with others excluded and may not be included in performance improvement activities.

Methods: Hospital mortalities for 1 year were evaluated for any surgical involvement (SI). The type of surgical contact, whether SI contributed to the mortality, and preventability were determined.

Results: Of the 734 mortalities, 247 met the inclusion criteria. Overall, 108 patients (43.7%), were admitted to Medicine (MS). While 111 patients (45%) underwent an operation, 136 (55%) never did.

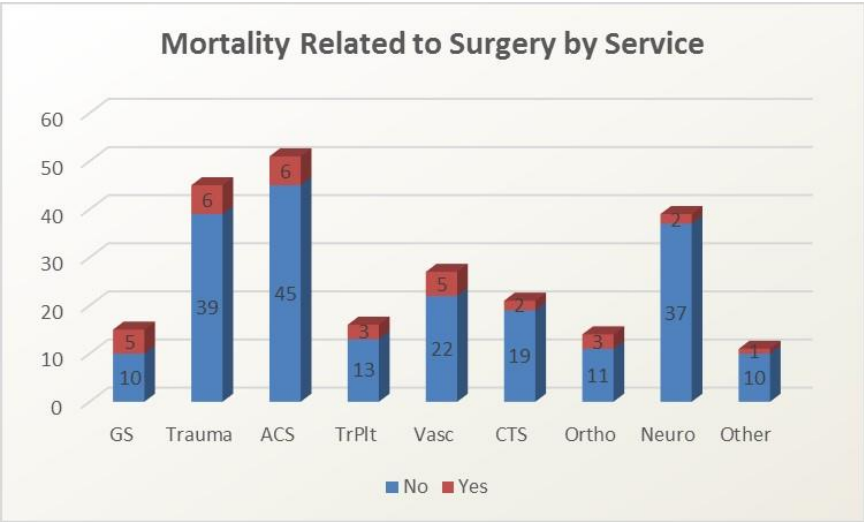


Chart 1. Cases that the surgical interaction contributed to the mortality

The majority of deaths (235, 95%) occurred in patients transferred or emergency admissions. The SI directly contributed to the mortality in 33 patients (13.4%), (Chart 1). In some cases this was related to a delay in primary operation in 8 (3.2%), delay in subsequent operation in 2 (0.8%), inappropriate operation in 2 (0.8%), failure to operate in 7 (2.8%), and unindicated operation in 3 (1.2 %). There were 8 (3.2%) preventable and 33 (13.4%) possibly preventable mortalities.

Conclusion: Hospital mortality directly related to surgery is uncommon, with emergency patients most likely involved. Most mortalities occur in patients not undergoing an operation, but with some SI. These patients may escape the usual surgical mortality review process, unless a robust quality review system which evalutes the care of all surgical patients is implemented. This is especially the case for trauma and acute care surgery as they tend to have the greater number of mortalities. Also, this type of review can determine issues involving consultation and care, as well as identifying patients for educational and corrective actions.

Poster # 56

Validation of a Trauma Outcome Model Including Age and an American Society of Anesthesiologists Physical Status Classification Based Score Utilizing National Trauma Data Bank Comorbidity Data

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Introduction: Pre-injury American Society of Anesthesiologists Physical Status Classification (ASA-PS) predicts trauma mortality. However, ASA-PS suffers from issues related to precision, inter-rater reliability, influence of injury, and documentation error. To overcome these inherent difficulties, an ASA-PS based model utilizing available National Trauma Data Bank (NTDB) comorbidity data was previously developed and correlated with trauma mortality. The purpose of this study was to externally validate the predictive performance of a trauma outcome model including age, ASA-PS based comorbidity score, and Injury Severity Score (ISS).

Methods: An internally validated database of admitted adult trauma patients consistent with NTDB and American College of Surgeons standards was examined. Our initial cohort, used to develop the ASA-PS based comorbidity score, consisted of 9,036 patients from 2009-2013. A second cohort was developed with a prospective sample of 2,494 patients from 2014. Patients were excluded from this group on the basis of incomplete ISS or comorbidity data for a total of 2,470 patients. ASA-PS based comorbidity scores utilizing NTDB-defined comorbidities were derived. Logistic regression analysis of the initial cohort was performed to develop predictive models of mortality utilizing age, ASA-PS based comorbidity score, and ISS as covariates. The performance of the model was studied using the second cohort.

Results: The two patient cohorts had similar age (48.6 yr vs. 52.4 yr), gender (M: 65.7% vs. 60.5%), mechanism of injury (blunt: 87.8% vs. 90.5%), ISS (9.99 vs. 9.42), length of stay (5.02 d vs. 4.78 d), hospital mortality (3.5% vs. 2.7%), major complication rate (16.5% vs. 10.7%), and discharge home (67.3% vs. 64.3%).

A logistic regression analysis model was developed utilizing the initial cohort:

Predicted probability of mortality = (e^(-7.291+0.029*AGE+0.249*CCM+0.112*ISS)) / (1+e^(-7.291+0.029*AGE+0.249*CCM+0.112*ISS)).

The coefficients were statistically significant (<0.005 to 0.002). The Cox & Snell and Nagelkerke R square values were 0.077 and 0.294, respectively. The Hosmer and Lemeshow Chi-square value was 19.56 (p=0.012).

The model was tested using the second cohort. When comparing the study model to a model with ISS only, discrimination (AUROC: 0.893 vs. 0.797) and calibration was improved (Brier Score: 0.024 vs 0.025).

Conclusion: A logistic regression model predictive of mortality, utilizing age, ISS and an ASA-PS based comorbidity score, was developed and externally validated. Age and comorbidity data should be included in future predictive models of trauma mortality.

Poster # 57

FACTORS WHICH PROLONG THE INTERVAL TIME BETWEEN CLINICAL BRAIN DEATH EXAMS AND POTENTIALLY DECREASE ORGAN DONOR CONVERSION RATE

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Introduction: Timely declaration of brain death (BD) is important to organ donation. Our urban level I trauma center's BD policy calls for two clinical exams at least six hours apart. We reviewed factors that prolonged interval time between BD exams in order to understand the effect a delay in determination of BD had on subsequent conversion to organ donation.

Methods: A review of all patients determined clinically brain dead between October 31, 2010 and December 31, 2013 was performed. Times of required clinical brain death exams, admitting service, presence of ancillary tests, consent to organ donation, organ donor eligibility, and final organ donor status were recorded. Once testing for normality in outcome variable distribution using a Kolmogorov-Smirnov statistic ($D = 0.23$; $p < 0.01$), means were compared using two-sample Student's T-tests. Organ donor conversion rate (ODCR) and consent rate were calculated and compared using two-sample Z-tests. Only patients who had at least 6 hours between brain death exams were included in analysis. Outliers (n=2) were defined as subjects whose time between exams was further than three standard deviations from the mean; these subjects were removed from analysis.

Results: 78 patients met inclusion criteria.

	Total (n=78)	Trauma (n=52)	Non-trauma (n=26)	p-value
Age (years)	39.9 ± 18	34.4 ± 16	50.9 ± 14	$p < 0.05$
% Male	70.5%	80.8%	50.0%	$p < 0.05$
ODCR	70.7%	82.2%	45.0%	$p < 0.05$
Consent rate	72.7%	82.3%	53.9%	$p < 0.05$
Time between exams (hours)	10.3 ± 4.4	10.2 ± 5	10.6 ± 4	p = NS

Time between exams was prolonged in patients who received ancillary tests compared to those who did not receive ancillary tests (15.8 ± 12.2 vs. 10.1 ± 4.3; $p < 0.05$). ODCR for those who did not receive ancillary tests was 73.0%, and ODCR for those who did receive ancillary tests was 61.5% (p = NS). Eligible organ donors had a shorter interval between exams than ineligible donors (10.3 ± 5 vs. 14.9 ± 12; $p < 0.05$).

Conclusion: Trauma patients have a higher ODCR than non-trauma patients. However, increased interval time between BD suspicion and confirmatory testing adversely affects these rates. Efforts should be made to expedite and streamline BD testing, perhaps through the implementation of a policy using a single BD exam.

Poster # 58

IS IT SAFE TO ADMIT PATIENTS WITH ACUTE INJURIES TO NON-SURGICAL SERVICES?

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Introduction: Patients with acute injuries are occasionally admitted to non-surgical services. Since there may be a theoretical safety risk for this practice, the American College of Surgeons mandates all trauma centers to review and determine appropriateness of each such admission. Surprisingly, although this has been a long-standing concept, there is no data to support it. The present study aimed to shed light on this issue by characterizing this group of patients and by determining their outcome.

Methods: This retrospective study reviewed adult (≥16-years) trauma patients admitted to an urban Level 1 trauma center in 2012- 2014. Demographics, co-morbidities, injury patterns, injury severity score (ISS), lengths of stay (LOS), morbidities and mortality were compared (Chi-square analysis and t-tests, as appropriate) between non-surgical admitted (NSA) and surgical admitted (SA) patients. A multivariate logistic regression model was used to identify predictors of mortality.

Results: There were 2,426 admissions, of which 415 (17%) were NSA. Compared with SA patients, NSA patients were older (73 ± 17 vs. 55 ± 23 years, $p \leq 0.001$), had more females (59% vs. 41%, $p<0.001$) and more co-morbidities/patient (1.55 ± 1.13 vs. 0.89 ± 1.05, $p<0.001$). Hypertension and diabetes were the two most prevalent co-morbidities in both groups, but were more frequent in the NSA group (58% vs. 32%, $p<0.0001$, 22% vs. 10%, $p<0.0001$, respectively). Falls were the most common mechanism of injury (90% in NSA vs. 60% in SA, $p<0.0001$), and mostly the lower extremities were injured (51% in NSA vs. 39% in SA, $p<0.0001$). NSA patients had a lower mean ISS (7.2 ±4.5 vs. 13.0 ± 9.3, $p<0.001$), and the two groups did not differ in complication rate (2.9% in NSA vs. 3.5% in SA, $p=0.514$) or median LOS (3 days in each group, $p=0.11$). However, mortality was lower in the NSA group (1% vs. 3%, $p=002$), with all 4 deaths due to respiratory failure unrelated to the injuries per se. Multivariate logistic regression analysis, controlled for age, gender, ISS, and co-morbidities, identified increased age (odds ratio (OR): 1.03, 95% confidence interval (CI): 1.02, 1.05, $p \leq 0.001$), increased ISS (OR: 1.13, 95% CI: 1.10, 1.15, $p \leq 0.001$), as predictors of mortality.

Conclusion: Although NSA patients had less severe injuries, their hospital LOS, complication rate and mortality were similar to SA patients. This is likely due to the higher age and higher comorbidity rate in the NSA group. As mortality in NSA patients resulted from respiratory failure unrelated to the traumatic injuries, admission of selected patients to non-surgical services may be safe.

Poster # 59

LONG-TERM EFFICACY OF AN INFERIOR VENA CAVA FILTER RETRIEVAL PROTOCOL

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Introduction: Inferior vena cava (IVC) interruption remains controversial in trauma patients due to variability in venous thromboembolism prophylaxis among patients with significant traumatic brain injury, spinal cord/column injuries, and/or complex orthopedic trauma. Despite the use of retrievable IVC filters in trauma patients, actual "retrieval" rates vary significantly. The objective of this study was to evaluate the long-term efficacy of a retrieval protocol.

Methods: A retrospective review of a prospective database was completed for all patients who underwent IVC filter placement. A retrieval protocol was implemented in January 2005. Retrieval rates during the pre-protocol period (January 2003–February 2005) were compared to those post-protocol (March 2005–December 2013). Early and late post-protocol periods (March 2005–March 2009 vs. April 2009–December 2013) were evaluated for long-term protocol compliance. Statistical analysis included Fisher's exact and Wilcoxon rank sum tests.

Results: There were 221 patients included; the mean age was 44 years and 75% were male. The median ISS was 29 (4-75). The most common indication for IVC filter placement was neurologic injury (78%). The retrieval protocol resulted in significant improvement in IVC filter retrieval rates, from 53% pre-protocol to 86% post-protocol (Table). In the post-protocol period, successful retrieval rates were maintained in the early and late periods (88% vs. 84%, respectively).

Variable	Overall	Pre-Protocol	Post-Protocol	*P* value
N	221	40	181	
Death <30 days or lost to follow-up, n (%)	44 (20)	6 (15)	38 (21)	
Retrievable, n (%)	177 (80)	34 (85)	143 (79)	
IVC filter outcome				<0.001
Retrieved successfully	141 (80)	18 (53)	123 (86)	
Unsuccessful attempt or non-retrievable	12 (7)	4 (12)	8 (6)	
No attempt at retrieval	24 (14)	12 (35)	12 (7)	
Filter clot, n (%)	9 (4)	1 (3)	8 (4)	0.99
Tilted filter, n (%)	10 (5)	1 (3)	9 (5)	0.69
Median filter indwelling time, days	70 (8-739)	93 (11-739)	69 (8-436)	0.19

Conclusions: A structured, protocol-driven approach to IVC filter retrieval resulted in significant and sustained improvement in retrieval rates and indwelling filter duration.

Poster # 60

GOAL DIRECTED ENOXAPARIN DOSING PROVIDES SUPERIOR CHEMOPROPHYLAXIS AGAINST DEEP VEIN THROMBOSIS IN TRAUMA PATIENTS

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introduction: Optimal enoxaparin dosing for deep venous thrombosis (DVT) prophylaxis remains elusive. Prior research demonstrated that trauma patients at increased risk for DVT based upon Greenfield's risk assessment profile (RAP) have DVT rates of 10.8% despite mechanical and pharmacologic prophylaxis. The aim of this study was to determine if goal directed prophylactic enoxaparin dosing to achieve anti-Xa levels of 0.3-0.5 IU/ml would decrease DVT rates without increased complications.

Methods: Retrospective review of patients admitted over a 24-month period at a Level 1 trauma center having received prophylactic enoxaparin and appropriately timed anti-Xa levels was performed. Dosage was adjusted to maintain an anti-Xa level of 0.3-0.5 IU/ml. RAP was determined on each patient and a score of $\geq$5 was considered high risk for DVT. Sub-analysis was performed on patients who received duplex examinations subsequent to initiation of enoxaparin therapy to determine the incidence of DVT. The presence of a proximal lower extremity DVT was considered a positive evaluation.

Results: 306 patients met inclusion criteria with mean demographic data as follows: age 40 years (range, 15-92), ISS 27 (range, 2-75), and length of stay 15 days (range, 3-88). Goal anti-Xa levels were met initially in only 46% of patients despite dosing of $\geq$ 40 mg twice daily in 81% of patients; however, with titration, goal anti-Xa levels were achieved in an additional 109 patients (36%). An average enoxaparin dosage of 0.55mg/kg twice daily was required for adequacy. Bleeding complications were identified in five patients (1.6%) with three requiring intervention. Aspirin and/or warfarin were being administered in 67% of patients at the time bleeding occurred. There were no documented episodes of HIT. Subsequent duplex data was available in 197 patients with 90% having a RAP score $\geq$5. Overall, five DVTs (2.5%) were identified and all occurred in the high-risk group. Among them, enoxaparin therapy was initiated on average hospital day 3 (range, 1-5) and mean time from admission to diagnosis of DVT was 13 days (range, 8-18). All patients were asymptomatic at the time of diagnosis.

Conclusion: An increased anti-Xa range of 0.3-0.5 IU/ml was attainable but frequently required titration of enoxaparin dosage. This produced a lower rate of DVT without increased complications.

Poster # 61

ANTICOAGULANT USE CONTRIBUTES TO INCREASING MORTALITY AFTER GROUND-LEVEL FALL

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Introduction: Injury from ground-level falls is the most common mechanism of injury found in the American College of Surgeons National Trauma Data Bank. With the population of those aged 65 or older expected to double over the next 40 years, the impact of falls on healthcare systems will continue to increase. The objective of this study was to identify how patients sustaining falls and their outcomes have evolved over the past 10 years. We hypothesized that although more patients would be on anticoagulant medication at the time of a ground-level fall compared with 10 years ago, mortality rates would not be significantly different due to improvements in trauma and geriatric care.

Methods: Retrospective data on patients sustaining a ground-level fall over two separate time periods (1998-2003 and 2008-2013) at a Level 1 trauma center was collected. Patient demographics, injury severity scores, outcomes, and costs were analyzed and compared between time periods using Student's t-tests and Wilcoxon rank sum tests. Primary outcome to assess evolution of ground-level falls was mortality. Data on anticoagulant use and comorbidities was gathered by a retrospective chart review of all patients treated during 2003 and 2013. Alpha level for statistical significance was 0.05.

Results: There were 7,006 patients treated for ground-level fall, with a 14.3% increase in number of patients in the more recent five years. The percentages of patients over the age of 65 and over the age of 80 increased significantly. There was a statistically significant increase in mean injury severity score, percentage of patients admitted to an intensive care unit (ICU), total cost of care, and mortality rate (Table 1). The percentage of patients on anticoagulant medications at the time of injury between 2003 and 2013 increased significantly (10.5% [57/542] compared with 16.5% [86/522], respectively, $p = 0.005$), and is associated with an increased risk of in-hospital mortality following ground-level fall (OR 3.2, 95% CI: 1.76, 5.90). There was not a significant difference in the mean number of major comorbidities per patient between the two time periods.

Conclusion: Anticoagulant use is associated with increasing mortality among ground-level fall patients. Compared with 10 years ago, ground-level fall patients are more frequently on anticoagulant medications, have more severe injuries, higher ICU admission rates, higher treatment costs, and increased mortality. Addressing the specialized needs of these patients is imperative in order to obtain better outcomes in a cost-conscious healthcare environment. Further understanding of how different classes of anticoagulants impact mortality after ground-level falls is warranted.

Table 1: Differences seen between ground-level fall patients during two distinct time periods

	1998-2003 (n=3270)	2008-2013 (n=3736)	P-value
Age > 65, %(n)	44.3 (1449)	50.6 (1892)	< 0.001
Age > 80, %(n)	22.0 (721)	27.9 (1044)	< 0.001
Injury Severity Score (Mean ± SE)	8.63 ± 0.11	9.49 ± 0.10	< 0.001
ICU Admission Rate, %(n)	16.2 (530)	33.9 (1267)	< 0.001
Total Normalized Cost (Median [IQR])	$8,480 ($4,553-$14,545)	$11,443 ($5,467-$19,894)	< 0.001
Mortality Rate, %(n)	3.06 (100)	4.47 (167)	0.002

Poster # 62

SIGNIFICANCE OF TROPONIN ELEVATION AFTER TRAUMATIC INJURY

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Introduction: Elevated troponin, even in the absence of acute coronary syndrome, has been associated with frailty, poor outcomes, and increased mortality. An association between elevated troponin and physiologic stress in trauma patients has been suggested. “Classic” therapy for elevated troponin levels includes aspirin, beta blockers, and statins. We hypothesize that increased troponin reflects poor patient outcomes after trauma and medical therapy may mitigate this effect.

Methods: We reviewed charts of all injured patients admitted to a Level 1 trauma center between January 1, 2009 and June 30, 2014 who had a troponin level checked during their hospital stay. We compared those patients with normal troponin to those with elevated troponin levels (>0.02 ng/mL). For patients with elevated troponins, we evaluated the use of "classic” therapy with maximal medical management with aspirin, beta blockers, and statins, or with any medical therapy with any one of those medications at three different time points: pre-hospital, within 72 hours of admission, and at discharge.

Results: A total of 907 patients met our inclusion criteria, 413 with elevated troponin and 494 with normal troponins. Patients with elevated vs. normal troponin levels were more likely to die (22% vs 6%, $p<0.001$). These groups had similar gender distributions (69% vs. 70% male, $p=0.632$) and pre-hospital medical therapy with aspirin, beta blockers, or statins (36% vs 30%, $p=0.0875$). However, those with elevated troponins were older (mean age 58 vs 55, $p=0.046$) with higher rates of coronary artery disease (25% vs 15%, $p<0.001$) and higher injury severity score (ISS 22 vs 18, $p<0.001$). Mortality among those treated with “classic” therapy (70/413) was half that of patients with elevated troponins who did not receive maximal medical therapy (10% vs. 24%, $p=0.010$) but they were also less severely injured (mean ISS 16 vs 23, $p<0.001$). Patients given any medical therapy after admission (249/413) were older (63 vs 51 yrs, $p<0.001$) and had lower ISS (20 vs 24, $p=0.0012$) than those who received no aspirin, beta blockers, or statins; yet they had significantly lower mortality (10% vs. 40%, $p<0.001$). Only 39 patients died in the first 2 days, 5 of whom had received medical therapy. Excluding patients who died within the first 48 hours, an association between medical management and improved survival is confirmed controlling for age, sex, ISS, and length of stay (odds of survival with any medical management 2.8, $p=0.004$).

Conclusion: This large cohort of trauma patients confirms an association between elevated troponin, severity of injury, and mortality. Patients with an elevated troponin who received medical therapy had decreased mortality even when controlling for many possible confounders. The retrospective nature of this study introduces survivor bias and differences between cohorts including injury patterns that may have precluded medical therapy. Prospective studies evaluating the use of medical therapy in trauma patients with elevated troponins may support this protective effect.

Poster # 63

TIME IS ON OUR SIDE: PRE-HOSPITAL RESUSCITATION INTERVENTIONS AND OUTCOMES IN SEVERELY INJURED PATIENTS

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Introduction: Effective and timely Pre-hospital intervention remains a vital component of Damage Control Resuscitation (DCR), helping stabilize severely injured patients prior to emergency department (ED) arrival. Availability of Emergency Medical Services (EMS) as well as adequate fluids and airway support are key components in effective transport of traumatic patients. We hypothesize improved survival in severely injured patients with the shortest transfer times.

Methods: This is a 1-year retrospective review of all adult patients with an ISS > 15 who were transferred to an urban Level 1 trauma center from by EMS from October 2013-2014. Age, sex, mechanism of injury (MOI), race, Injury Severity Score (ISS), lowest, highest, and average systolic blood pressure (SBP), heart rate (HR), Shock Index (SI), first and last Glasgow Coma Score (GCS), volume of infused normal saline and lactated ringers, airway type (AT) were analyzed in relation to mortality outcome. True Transfer Time (TTT), defined as time in transit from the scene to trauma center, and Total Pre-hospital Time (TPT), defined as time from the call received by EMS to arrival at trauma center were analyzed for impact on mortality. Analysis was performed using t-tests, chi-squared, and multiple logistic regression. Statistical analysis was completed using SAS 9.3.

Results: Of the 174 patients who met inclusion criteria, 146 had complete data for analysis. Twelve patients were excluded that had transfer SBPs of zero and died on arrival to the ED. Analysis was completed for 134 patients. Forty-two patients died (31%) and 92 patients lived (69%). When comparing patients that died versus lived, significant difference were found for: mean ISS (27.7 vs 21.3, p=<0.001); first and last GCS (mean first GCS: 8.3 vs 13.0, p=<0.001, and mean last GCS: 7.7 vs 13.2, p=<0.001); number of patients intubated 19% vs 2%, p=0.002 and average lowest HR recorded (79.4 vs 92.3, p=0.03) respectively. No differences were found for the rest of the variables including no difference between TTT or TPT when analyzed for mortality. On multivariate logistic regression significant predictors for mortality included: age, ISS, and lowest transfer SI (1.1). Risk of death was significantly increased with age (OR=1.1, 95% CI=1.0-1.1), ISS (OR=1.3, 95% CI=1.1-1.4), and lowest transfer SI (OR=20.3, 95% CI=1.6-254.6).

Conclusion: Mortality outcomes in an urban setting are increased with older age, higher ISS, and increased lowest transfer SI, but not with transfer times, resuscitation with crystalloid or intubation. SI does not take into account cardiopulmonary resuscitation during transfer, and therefore may not be a useful pre-hospital predictor of mortality. Further investigations into which pre-hospital interventions impact survival are warranted.

Table 1: Predictors of Mortality

Effect	Odds Ratio	95% Confidence Interval
Age	**1.07***	1.028-1.121
Female vs. Male Sex	2.03	0.36-11.44
Blunt vs. Penetrating Injury	0.30	0.06-1.57
Black vs. White	0.90	0.16-5.24
Asian vs. White	0.88	0.00-407.56
Other Race vs. White	5.35	0.35-81.49
ISS	**1.26***	1.12-1.41
Lowest SBP, ≤90 vs. >90	0.30	0.03-2.77
Highest SBP, ≤90 vs. >90	0.27	0.00-16.82
Average SBP, ≤90 vs. >90	4.52	0.05-391.86
Lowest HR, ≤100 vs. >100	0.82	0.05-12.58
Highest HR, ≤100 vs. >100	0.38	0.03-4.56
Average HR, ≤100 vs. >100	0.35	0.01-10.39
Lowest Shock Index, ≤1.1 vs >1.1	**20.26***	1.61-254.61
Highest Shock Index, ≤1.1 vs >1.1	0.78	0.03-18.02
Average Shock Index, ≤1.1 vs >1.1	0.94	0.03-30.65
Not Intubated vs. Intubated	4.55	0.32-64.41
First GCS, ≤8 vs. >8	0.00	0.00-999.99
Last GCS, ≤8 vs. >8	999.99	0.00-999.99
Crystalloid Requirements, <500mL vs. ≥500mL	1.10	0.29-4.20
True Transfer Time in minutes	1.06	0.92-1.22
Total Prehospital Time in minutes	0.96	0.86-1.08

* Denotes significance with p < 0.05. ISS: injury severity score, SBP: systolic blood pressure in mmHg, HR: heart rate in beats per minute, GCS: Glasgow coma score

Poster # 64

A POPULATION-WIDE ASSESSMENT OF FACTORS ASSOCIATED WITH NON-OPERATIVE MANAGEMENT OF PEDIATRIC SPLENIC INJURY

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Introduction: Nonoperative management of pediatric splenic injury is an established benchmark of quality pediatric trauma care. Studies demonstrate that splenectomy rates are lower at pediatric trauma centers compared to adult trauma centers. However almost 30% of children with trauma are cared for in non-trauma centers where there is minimal information regarding splenectomy rates. We evaluate variation in care for the entire population of US children with splenic injuries at non-trauma, adult trauma, and pediatric trauma centers.

Methods: We used the National Inpatient Sample (NIS), the largest publicly available all-payer inpatient US database (2001-2010), with data from more than 7 million unweighted hospitalizations, estimating more than 36 million hospitalizations per year. Patients 1-17 years with splenic injuries (ICD-9 CM 865.00-.19) were identified. We linked the NIS data with the American Hospital Association (AHA) 2008 survey to identify hospital capabilities and characteristics. An adult trauma center was defined as a Level I or Level II trauma center; because pediatric trauma centers are not explicitly identified in the AHA survey, a pediatric trauma center was defined as a trauma center with a pediatric ICU. We analyzed demographic: age, gender, race/ethnicity, payment source; clinical: Injury Severity Score (ISS), hemodynamic stability; and facility: hospital region, rural/urban status and size, variables. The primary outcome was splenectomy. The relationship between splenectomy and pediatric and trauma expertise of the treating hospital was analyzed, controlling for year, demographic, and clinical variables. Our study design and analyses account for the complex sampling design inherent in the NIS.

Results: Over the study period, we identified 37,441 patients with splenic injury; 26.5% at non-trauma, 16.3% at adult trauma, and 57.2% at pediatric trauma centers. 4,684 (12.5%) patients underwent splenectomy: 15.4% at non-trauma, 19.4% at adult, and 9.2% at pediatric trauma centers. Multivariable regression analysis demonstrated that patients had decreased odds of splenectomy at pediatric trauma centers ($OR = 0.45$, $p < .001$) when compared to adult and non-trauma centers. Children 14-17 years ($OR = 2.7$), an ISS > 14 ($OR = 5.3$), open cavity wound ($OR = 2.8$), and hemodynamic instability ($OR = 6.1$) (all $p < .001$), were at increased odds of undergoing splenectomy. When the analysis was restricted to children 1-13 years of age, results were qualitatively similar although confidence intervals increased due to a decrease in the study population to 16,725 patients.

Conclusion: In this nation-wide sample, children treated at non-trauma centers had a significantly higher rate of splenectomy despite a significantly less severely injured patient population, compared to children treated at pediatric trauma centers. We believe these trends reflect differences in the commitment to splenic salvage as well as comfort with the hemodynamics of seriously injured children in pediatric specific vs. non-trauma hospitals.

Poster # 65

DISPARITIES IN ACCESS TO INPATIENT REHABILITATION SERVICES AMONG PEDIATRIC TRAUMA PATIENTS

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Introduction: Although intensive rehabilitation services are known to improve functional outcome for trauma, pediatric inpatient rehabilitation units are scarce. California, home to approximately 9 million US children, has 10 pediatric specific inpatient rehabilitation programs with a total of approximately 225 beds. While there is evidence that there are nonclinical disparities in access to rehabilitation services in adults with traumatic brain injury, to the authors' knowledge, there are no studies of pediatric access to rehabilitation services. In this study, we hypothesized that racial/ethnic and socio-economic disparities influence access to pediatric inpatient rehabilitation services after serious trauma.

Methods: Children (ages 0-18 years), admitted for trauma to our free-standing children's hospital, a level I pediatric trauma center with an inpatient rehabilitation program, were identified from our trauma registry (2004-2014). We analyzed demographic: age, gender, race/ethnicity, payer source, county of residence and distance from residence to hospital; clinical: injury mechanism, body area injured, Injury Severity Score (ISS), and Abbreviated Injury Scores (AIS). The primary outcome variable was disposition (rehabilitation vs. home). Seriously injured children (ISS>9) who were admitted to our inpatient rehabilitation unit (cases) were matched with children discharged home (controls) by age category, gender, body region of injury and maximum AIS. A 1:N matching was performed to increase the precision of our study, resulting in a matched cohort of 382 records. A total of 87 cases were matched to 191 controls. 37 (40.2%) cases were matched to 1 control; 52 (59.8%) cases were matched to 3 controls. Eleven cases were unable to be matched due to controls lacking similar matched characteristics. ISS indicated clinical similarity between the two groups with median (IQR) of 19 (16-25) for children admitted to rehab and 16(16-25) for children discharged home. Multivariate logistic regression was used to identify factors associated with rehabilitation services, controlling for multiple injury, distance from home to rehab center, year of service, and hospital length of stay and clinically relevant interactions.

Results: Of 4,252 patients, 1,139 (26.8%) were seriously injured with an ISS of >9. Among 1,139 seriously injured children, 98 (8.6%) were admitted to inpatient rehabilitation, 968 (85.0%) were discharged home, 48 (4.2%) died and 25 (2.2%) had an "other" disposition. The median age (IQR) of the 98 patients admitted to rehabilitation was 5.0 years (3-12) compared to 7.0 (3-12) for the 968 discharged home. Multivariable regression analysis demonstrated that black and "other" race/ethnicity patients had increased odds of going to rehabilitation compared to white patients (OR 5.0, $p<.001$ and OR 1.2, $p=.01$, respectively), and patients with private compared to public insurance had increased odds of rehabilitation (OR 2.2, $p=.006$).

Conclusion: Inpatient pediatric rehabilitation beds are a scarce resource which should be available to those in most clinical need. While our findings of race/ethnicity disparities, despite careful adjustment could be secondary to the primary population of our inner-city trauma center and analyses should be repeated in a larger population, the disparities secondary to payer status warrant careful consideration in this era of initiatives to reform public payer programs for children.

Poster # 66

IMROVING EVALUATION OF COMPLICATIONS IN CRITICALLY INJURED CHILDREN THROUGH A NOVEL DATABASE

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Introduction: Efforts to improve pediatric trauma outcomes depend on the availability of detailed data to assess processes of care, optimally collected at the lowest cost. Trauma registries have been developed primarily to direct quality improvement. We developed the Pediatric Trauma Assessment and Management (PTAM) database by merging two independent data systems at five Pediatric Trauma Centers (PTCs) to assess quality of care provided to critically injured children throughout their hospitalization.

Methods: Trauma registry (TR) and pediatric intensive care unit (Virtual PICU Systems, VPS) data were merged for all children < 18 years old discharged from the PICU with ICD-9 codes 800-859.9, indicating a traumatic injury, between January 1 and December 31, 2013. Additional variables abstracted from the medical record targeted imaging, resuscitation, and ICU management practices.

Results: A total of 692 children were included in the merged database. TR data captured 83 complications in 57 children. Among the four complication types captured by both databases, the TR captured 13 total complications and the VPS captured 47; TR thus missed 72% of serious complications. For history of cardiac arrest, the TR captured four cases and VPS identified 37, a 9.3-fold increase. For unplanned return to the PICU, the TR captured three cases, while VPS captured 14, a 4.7-fold increase. Data capture for catheter-related blood stream infections (1 vs. 2.2-fold increase) showed similar findings. The TR data indicated a total of 192 children were mechanically ventilated at some point during their PICU stay, whereas the VPS data identified 226 children who were ventilated, a 17.7% increase. While no unplanned intubations were captured in the TR, VPS data identified at least 20 children requiring re-intubation, and four children requiring a third intubation. Pneumonia was the only complication captured with equal frequency (5 vs. 5). Complication ascertainment from the TR varied by site and by type of complication. For cardiac arrest, only one site's TR captured events; however it only accounted for about one-third of the cases identified by VPS at that site.

Conclusion: In a time when mandates require detailed complication reporting and when fiscal constraints require innovative approaches to data capture and evaluation, the merging of two existing databases successfully augments identification of complications, increasing accuracy and accountability, and offering more accurate data for quality improvement. Reliance on TR data alone appears inadequate.

Poster # 67

DON'T WASTE YOUR TIME: STRAIGHT TO MRI FOR PEDIATRIC BURNERS AND STINGERS

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Introduction: Burner or Stinger syndrome (BSS) also known as transient brachial plexopathy is commonly seen with contact sports. There is no consensus on clinical management and radiographic evaluation of pediatric patients with sports related BSS. This study aims to assess the feasibility of clinical observation without extensive radiologic workup in pediatric patients with BSS given the low likelihood of permanent neurologic injury.

Methods: A retrospective, observational study of patients under the age of 18, evaluated at a Level 1 Trauma Center was conducted. Patients included had a concern for BSS after a contact sport injury. Over a 24 month period beginning in January 2012, data was collected from our institutional trauma registry and electronic medical record. Patient demographics, physical complaints, physical exam findings, imaging, and outcome data, were analyzed.

Results: Thirty patients were evaluated for BSS during the study period. Average age was 14.3 ± 2.3 years with a mean ISS of 2.7 ± 2.7. Football tackle was the most common mechanism of injury (56.7%). All patients had subjective motor and/or sensory deficits upon arrival. Patients were grouped by physical exam findings: 14 with motor deficits (MD), 2 with sensory deficits (SD) and 14 asymptomatic (AS). Twenty-six of thirty patients underwent CT cervical spine and only 1 AS patient (3.9%) had a positive finding. All patients with MD and SD had negative CT cervical spine. No positive findings were found in those who underwent CT thoracic or lumbar spine. Eight patients with MD underwent MRI cervical spine with two positive findings; no surgical interventions were required. On discharge, 28.8% had improvement and 71.4% had resolution of their motor symptoms. SD patients had negative MRI imaging and complete resolution of symptoms on discharge. Seven patients with AS underwent MRI cervical spine; two had ligamentous injury which required a cervical collar for management. On discharge, 71.4% had resolution of symptoms and 21.4% had improved symptoms. Total cost of CT scans incurred were approximately $89,944.

Conclusion: Children presenting with BSS experience temporary symptoms that resolve without surgical intervention. Assessment by CT scans is an insensitive imaging test compared to MRI. It exposes pediatric patients to unnecessary radiation and increases hospital costs. Therefore, the preferred management for BSS should include observation, serial neurologic exams and MRI evaluation as appropriate, but CT scans should be avoided.

Poster # 68

Penetrating Neck Trauma In Children: An Uncommon Entity Described Using The National Trauma Data Bank (NTDB)

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Introduction: Penetrating neck trauma is uncommon in children; consequently, data describing epidemiology, injury pattern and management is sparse—limited to small single-center studies. The aim of this study was to use the NTDB, a large national database, to describe pediatric penetrating neck trauma.
Methods: All NTDB patients less than 15 years old with penetrating neck trauma admitted in 2008 to 2012 were identified. Univariate and multivariate analyis was used to described the total group and stratified age groups 0-5, 6-10, and 11-14.
Results: Of 434,788 patients, 1238 (2.8%) were admitted for penetrating neck trauma. Mean age was 7.87 years and most were male (70.6%). The most common mechanisms were stabbing (44.1%) and firearm (32.1%). On admission, 8.2% were hypotensive and 7.2% were intubated. Only 8% of patients were imaged with CT scan. The most common injury types was aero-digestive (23.7%) and vascular (18.3%). Aero-digestive injuries were most frequent in the 0-5 age group (40.0%). Twenty-three percent of patients were taken directly to the operating room (OR) from the emergency department (ED). Overall, mortality and complications were 2.9% and 2.3%, respectively. After adjusting for age, ISS, and GCS, only hypotension and direct admission from ED to OR were significant predictors of mortality (OR 2.69 [CI 1.06 -6.84], OR 3.31 [CI 1.23-8.90], respectively)—injury type was not a predictor of mortality.

Characteristics	0-5 years old	6-10 years old	11-14 years old	P values
Stab Injury	258 (56.3%)	132 (43.9)	156 (32.6%)	<0.001
Gunshot/Firearm Injury	49(10.7%)	73(24.35)	179(37.4%)	<0.001
Mean Injury Severity Score (SD)	8.99 (11.96)	7.09 (10.15)	8.38 (10.70)	0.064
Vascular Injury	78 (17.0%)	51 (16.9%)	97 (20.3%)	0.353
Neurological Injury	6 (1.3%)	8 (2.7%)	21 (4.4%)	0.017
Cervical Vertebrae Injury	26 (5.7%)	22 (7.3%)	75 (15.7%)	<0.001
Aero-digestive injury	182 (39.7%)	58 (19.3%)	53 (11.1%)	<0.001
Operative Neck Procedures	65 (14.2%)	37 (12.3%)	73 (15.2%)	0.516
Mortality	15 (3.3%)	9(3.0%)	12(2.5%)	.778

Conclusion: Based on the NTDB, penetrating neck trauma in children is indeed an uncommon occurrence with a relatively low mortality and complication rate. Although injury type differs with age, it is not predictive of mortality. The majority of patients are managed non-operatively.

Poster # 69

EVALUATING IN-HOSPITAL TRIAGE: IS ISS OF 15 AN APPROPRIATE DEFINITION OF MAJOR TRAUMA?

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Introduction:

Defining appropriate in-hospital triage of trauma patients continues to be a challenge. Currently, methods such as the Cribari grid utilize retrospectively assigned injury severity scores (ISS) with a cut-off point of 15, defining patients requiring full trauma activation, to determine rates of under- and overtriage. This study aims to determine if an ISS of 15 is an appropriate cut-off point to assess under- and overtriage in the Cribari grid methodology.

Methods:

This study is a retrospective chart review of the trauma registry at an ACS-Verified Level One trauma center over a 13-month period. Data collected included age, level of trauma activation, disposition, time to operating room, length of stay (LOS), and ISS which was retrospectively assigned as part of the trauma registry.

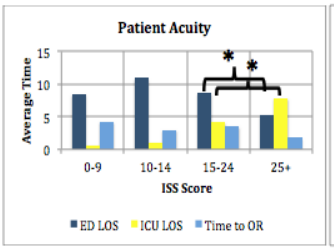
Results:

1863 patients were included for study analysis. 291 underwent full trauma activation, 334 partial activation, 753 consults, and 485 were not assessed by the trauma service. Of those patients with full activation, 28.2% underwent immediate surgical intervention while 36.8% were admitted to the ICU. All 18 patients that died underwent full activation. 53.8% of patients that received trauma consults were admitted to the floor. A subgroup analysis revealed patients with an ISS $>$ 25 compared to those with an ISS $<$ 24 had a shorter time to the OR (1.8 vs. 3.6 hours, Figure 1), shorter ED LOS (5.3 vs. 8.7 hours, $p < 0.001$), and longer ICU LOS (7.9 vs. 4.1 days, $p < 0.001$). Patients with an ISS $>$ 25 had a higher mortality compared to patients with an ISS $<$ 24 (22.8% vs. 2.2%, $p < 0.001$, Figure 2). Given an ISS of 25 represented a clinically significant inflection point in patient mortality this was used as a new cut-off point in the Cribari grid. According to the traditional Cribari grid utilizing an ISS cut-off of 15, our institutions under- and overtriage rate was 35.50% and 50.17%, respectively. Utilizing our proposed ISS cut-off of 25, revealed an under- and overtriage rate of 11.51% and 64.26%, respectively.

Conclusion:

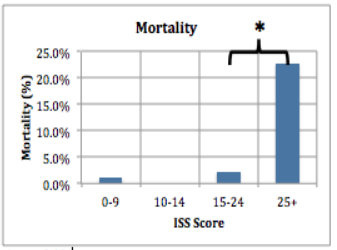
Post-hoc review of under- and overtriage rates using the Cribari grid methodology with an ISS cut-off of 15 does not appear to accurately reflect clinical acuity. Utilizing a higher ISS cut-off of 25 may better correlate with clinically appropriate trauma center under- at the expense of higher overtriage.

Figure 1



* = p < 0.001

Figure 2



* = p < 0.001

Poster # 70

UNDERGOING SURGERY FOR TORSO TRAUMA BEFORE CT SCAN MAY IMPROVE IN-HOSPITAL MORTALITY IN HYPOTENSIVE OR COMATOSE PATIENTS

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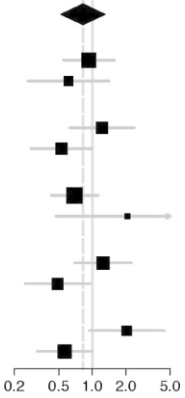
Introduction: CT scan before emergency trauma surgery enables surgeons to achieve early detection of critical injuries and is widely implemented in the early trauma care, however, concerns for risk of undergoing CT scan in unstable trauma patients still remains unsolved. This study purpose is to test a hypothesis that undergoing emergency truncal surgery before CT scan might benefit trauma patients with unstable vital signs.

Methods: In this case control study based on the Japan Trauma Databank (JTDB), we selected directly transferred trauma subjects which underwent any surgery on chest, abdominal or pelvic region within 120 minutes from the hospital arrival. Subjects without records of exact time of undergoing surgery and CT scan were excluded. Missing values in important variables were multiply (m=25) imputed. We defined the study intervention and the study outcome as surgery before CT scan and in-hospital mortality, respectively. Logistic regression analyses adjusted for the Trauma Injury Severity Score (TRISS) in overall subjects and subjects dichotomized by baseline characteristics to predict in hospital mortality estimated relative risk of surgery before CT scan (FIGURE). A propensity score matching analysis compared in-hospital mortality in subjects with or without surgery before CT scan.

Results: A total of 959 subjects was selected from 146111 trauma subjects registered in JTDB and 183 and 776 subjects underwent surgery before CT scan and CT scan before surgery, respectively. Predicted mortality based on TRISS method (41% versus 17%, P<0.001) and observed in-hospital mortality (45% versus 24%, P<0.001) were both higher in subjects underwent surgery before CT scan in comparison of subjects underwent CT scan before surgery. FIGURE1 showed association of surgery before CT scan and in-hospital mortality in overall subjects and dichotomized subgroups after adjustment for TRISS. Adjusted risk for in-hospital mortality in overall subjects with or without surgery before CT scan was similar (OR 0.83, 95%CI [0.52-1.30], P=0.398). Significant interactions were observed in subgrourps dichotomized as the subjects with systolic blood pressure <100 mmHg or ≥100mmHg (OR 0.57 versus 2.04, P for OR interaction=0.009) and with the Glasgow Coma Scale of 3-8 or 9-15 (OR 0.49 versus 1.25, P for OR interaction=0.037).

FIGURE 1. Association of Surgery before CT Scan and In-Hospital mortality

Subgroups	N	OR [95%CI]	P	P for OR interaction
Overall subjects	**959**	**0.83 [0.52–1.30]**	**0.409**	
Gender				
Male	695	0.93 [0.55–1.58]	0.796	0.398
Female	264	0.61 [0.27–1.42]	0.252	
Age				
≥50 y.o	439	1.22 [0.63–2.38]	0.554	0.071
<50 y.o	520	0.53 [0.28–1.00]	0.050	
Type of trauma				
Blunt injury	621	0.70 [0.43–1.13]	0.139	0.170
Penetrating injury	338	2.06 [0.47–8.99]	0.336	
Glasgow Coma Scale				
9–15	727	1.25 [0.70–2.25]	0.453	0.037
3–8	232	0.49 [0.25–0.95]	0.035	
Systolic blood pressure				
≥100mmHg	496	2.04 [0.94–4.42]	0.071	0.009
<100mmHg	463	0.57 [0.32–1.00]	0.049	



A propensity score matching analysis selected 135 and 135 subjects with surgery before CT scan and CT scan before surgery, respectively. Standardized difference of all the variables which were included for the propensity score estimation did not exceed 0.1, therefore those groups were considered to be well balanced. Intergroup comparison in propensity score matched groups showed shorter door to surgery time in subjects with surgery before CT scan (mean of 52 minutes versus 84 minutes, P<0.001) and similar in-hospital mortality (39% versus 39%, OR 1.00, 95%CI 0.61-1.65, P=0.988).

Conclusion: Overall benefit in surgery before CT scan still remained uncertain in trauma patients requiring early truncal surgery within 120 minutes from the hospital arrival, however, surgery before CT scan significantly related to improved in-hospital mortality in hypotensive or comatose trauma patients. Limitation of our study result was retrospective nature of the study design and possible
presense of unmesurable confounders to select surgery before CT scan. Prospective and hypothesis driven cohort study is needed to demonstrate benefits of surgery before CT scan in hypotensive or comatose trauma patients who needs emergency truncal surgery.

Poster # 71

OUTSIDE HOSPITAL IMAGING: A WEB-BASED PLATFORM FOR IMAGING SHARING ONLY FIXES PART OF THE PROBLEM

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Introduction: Repeat imaging following transfer of a trauma patient to a regional trauma center is a common occurrence. Whereas in the past repeat imaging was often required due to disparate systems at the sending and receiving hospital, newer web-based software has sought to eliminate this problem. Recent reports have demonstrated its efficacy at eliminating the problem of software incompatibility, however they had not examined whether this was the core problem necessitating repeat imaging.

Methods: All trauma patients transferred to a single level I trauma center from an outside hospital (OSH) during May 2010- April 2011 (PRE; prior to file sharing software) and August 2014 - February 2015 (POST; after file sharing software) were prospectively entered into a database. Information collected included patient demographics, mechanism of injury, imaging performed at the OSH and any performed at the receiving hospital within 6 hours of admission (or prior to surgery), and indication for the additional images. Financial charges were calculated for imaging studies based upon the actual charges for each study in February 201.

Results: 153 PRE and 104 POST patients were entered into the study. 5 PRE and 5 POST had no imaging performed at the OSH and were excluded from further analysis. Patients were not significantly different between the two time points with regards to age (34.4 ± 25.3 vs 40.6 ± 26.6 years), gender (72% vs 67% male), and mechanism of injury (93% vs 91% blunt). During the PRE phase 94% of patients arrived with OSH imaging on a disc, 3% had hard copies, and 3% arrived without copies of their imaging studies. During the POST phase 92% of patients arrived with OSH imaging on a disc, 3% had hard copies, and 5% arrived without copies of their imaging studies. Repeating imaging secondary to a failure to be able to view the images decreased from 14% PRE to 1% POST ($p<0.001$). There was a trend towards less repeat imaging due to inadequate or incomplete OSH imaging over time (32% PRE vs 22% POST; $p=0.079$), but this was not statistically significant. Imaging obtained after transfer incurred a mean of $5,588.95 ± 6,089.51 in charges per patient with potentially preventable imaging accounting for 20% of the charges during the POST time period.

Conclusion: Transferring trauma patients remains associated with a high rate of repeat imaging on arrival at the receiving hospital. This occurs at a significant financial burden. A web-based platform near completely eliminates software incompatibility problems, however this eliminated less than half of all repeat images.

Poster # 72

Trauma Exsanguination Protocols Are Feasible at Regional Level 3 and 4 Trauma Centers

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Introduction: Early Initiation of plasma-based trauma exsanguination protocols (TEPs) lowers mortality by approximately 2/3. We hypothesized that it is feasible to implement a plasma-based TEP at level 3 and 4 trauma centers without delaying transport.

Methods: We queried the state Trauma Registry for patients meeting positive screening criteria for TEP (positive ABC score) at all state level 3 and 4 trauma centers in 2013. We also surveyed all state level 3 and 4 centers to determine availability of blood bank plasma resources.

Results: In 2013, 2,069 trauma patients presented to a level 3 or 4 trauma center. 824 (39.8%) were transferred to a higher level trauma center. We identified 39 patients, in 13 of the 15 level 3/4 centers, who were ABC+ at initial presentation to the ER, thus meeting criteria for MTP. Eight of 13 level 4 centers responded to our survey and 2 of 3 level 3 centers responded. 75% of level 4's and both level 3's have FFP available. Mean thaw time was 29 minutes at all centers (range 15-45 minutes). Median total length of stay from registration to ER discharge for ABC positive patients was 1.78 hours, mean of 2.1 hours and range of 0.5-5 hours.

Conclusion: A significant number of patients at regional level 3 and 4 centers meet criteria for TEP, even in a rural state. Most level 3 and 4 trauma centers have FFP available and thaw times are such that its administration would not delay transport to a higher level of care. Since feasible, the authors recommend systematic implementation of TEPs at regional centers to reduce hemorrhage-associated mortality.

Poster # 73

TIMING & INCIDENCE OF MAJOR COMPLICATION FROM THE PRAGMATIC RANDOMIZED OPTIMAL PLATELET AND PLASMA RATIOS (PROPPR) TRIAL

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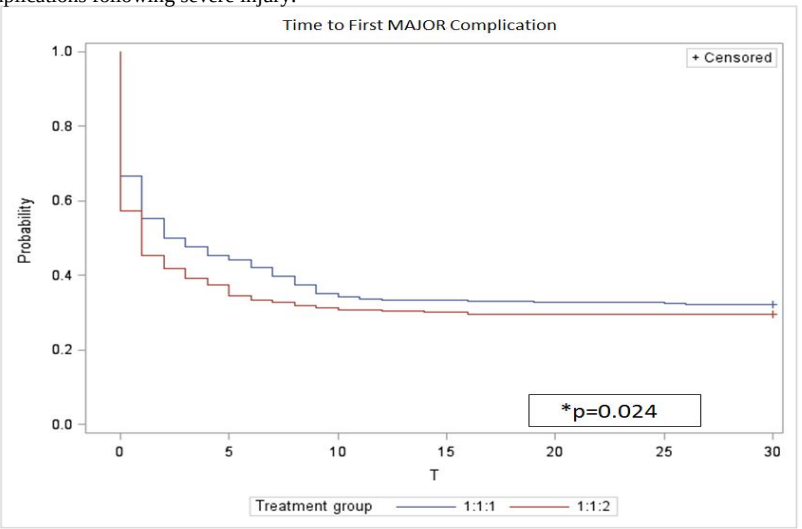
Introduction: Complications following major trauma are believed to be common, however, granular data regarding the timing and frequency have been widely variable in the literature. The discrepancies reflect bias of institutional registries and retrospective data. As part of the PROPPR trial, complications were predefined and prospectively documented following randomization to either a resuscitation ratio of 1:1:1 (plasma:platelets:RBC) or 1:1:2 in trauma patients predicted to require a massive transfusion (MT). This study investigates the impact of resuscitation ratio on the timing and incidence of major complications.
Methods: PROPPR was a randomized, multi-center trial at 12 Level 1 trauma centers with an enrollment of 680 patients predicted to require MT. Patients were followed prospectively and assessed daily for development of complications. 23 complications were pre-defined prior to the start of the trial and grouped into minor and major categories. Time to complications was compared.
Results: 470 patients (69%) experienced a major complication including death and there was no difference in the number of patients having a major complication between groups (229 pts vs 241 pts; 67.8% vs. 70.5%, p=0.44). Although the mean number of major complications per patient was equivalent (mean 1.8 vs. 1.9, p=0.75), the timing to the first major complication was later in the 1:1:1 group (p=0.024, FIGURE). Excluding deaths in the first 24 hours, the mean number of major complications remained equivalent (1.9 vs. 2.0, p=0.61) and the difference in timing remained significant. Most complications occurred early with pulmonary and renal the most frequent (<72 hours) whereas infectious complications peaked after 5 days. There were no differences in frequency of pulmonary complications. Among survivors to discharge, 59% in the 1:1:1 group and 60% in the 1:1:2 group experienced >=1 major complications. 40 survivors in the 1:1:1 group and 32 in the 1:1:2 group experienced no major or minor complications. Complications were common in patients who died with 61% and 58% in each group having a major complication prior to death. For those with pre-existing co-morbidities, no treatment effect was found for the number of major complications (p>0.20).
Conclusion: Major complications tend to occur early following severe trauma and are extremely frequent events. Balanced resuscitation appears to decrease the frequency of early major complications following severe injury.



Note: Major complications include deaths if death occurred before other major complications.

Poster # 74

THE RISK OF MISSING HYPERFIBRINOLYSIS USING VISCOELASTIC GUIDED TRANEXAMIC ACID ADMINISTRATION

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Introduction:Injury induced hyperfibrinolysis is associated with high mortality; this is decreased with tranexamic acid (TXA) treatment within 3 hours of injury. Viscoelastic analysis identifies hyperfibrinolysis, making it possible to provide directed TXA treatment. Although many viscoelastic transfusion algorithms have decision points within 20 minutes, recent data has shown hyperfibrinolysis can occur later and might be missed with this strategy. Identification through alternative analysis of early results might predict these later events. We sought to find whether early clot strength results on the initial viscoelastic analysis can predict late hyperfibrinolysis.

Methods:Data was collected on patients with highest trauma team activation at an urban, Level 1 trauma center from February to October of 2014. Rotational Thromboelastometry (ROTEM) analysis was performed on arrival and standard demographic data collected. Clot strength was measured in millimeters (mm) of amplitude at 10 minutes (A10) in the EXTEM analysis. Early clot weakness was defined as an EXTEM A10 < 40mm. Early and late hyperfibrinolysis were defined as maximum lysis >15% in < 20 minutes and >21 minutes, respectively. Results are median [IQR] with Mann-Whitney analysis.

Results:141 patients with 21.3% penetrating injuries (n=30) were evaluated; 118 (83.7%) patients had no evidence of clot weakness on initial analysis (52.5mm, [47, 56]). However, 2 of these patients developed late hyperfibrinolysis (1.7%). 23 patients had evidence of initial clot weakness (30mm, [25.5, 35]), of which 10 (43.4%) developed hyperfibrinolysis. Of these, 5 (50%) developed late fibrinolysis. In those patients with EXTEM A10 < 40 mm, clot strength was significantly weaker in those patients with early hyperfibrinolysis compared to those patients with no fibrinolysis (17mm, [1, 26] vs 33mm, [30, 36])($p<0.01$). Conversely, there was no difference in EXTEM A10 values in those with late hyperfibrinolysis (28mm, [25, 35] vs 33mm, [30,36]). All patients with hyperfibrinolysis died (100% mortality). The odds ratio of developing hyperfibrinolysis with initial clot weakness (A10 < 40 mm) was 44.6 (95% CI 8.8 to 226.1)$p<0.001$.

Conclusion:Patients with early clot weakness are at high risk for hyperfibrinolysis. However, hyperfibrinolysis develops at different rates and patients who develop late hyperfibrinolysis cannot be predicted by early clot weakness alone. Further, a small percentage of patients can develop late hyperfibrinolysis with normal early clot strength. Algorithms that aim to administer tranexamic acid based on viscoelastic results should monitor the initial analysis until completion to ensure optimization of treatment for all patients.

Poster # 75

TRANEXAMIC ACID ADMINSTRATION PROTECTS AGAINST ACUTE LUNG INJURY FOLLOWING SHOCK CONDITIONS: AN IN VITRO MODEL

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Introduction: Non-microbial factors released from the stressed gut after trauma/hemorrhagic shock (T/HS) result in a systemic inflammatory response and acute lung injury (ALI). Both ischemia/reperfusion (H/R) injury and intestinal luminal pancreatic proteases such as trypsin contribute to intestinal barrier injury in this setting. We have previously demonstrated that tranexamic acid (TA) in clinically relevant concentrations protect both the mucus and epithelial components of the intestinal barrier following exposure to H/R + trypsin in an in vitro model. We postulate that the protective effects noted on gut barrier function would mitigate ALI and remote organ injury following H/R in this model.

Methods: Caco-2/HT29-MTX intestinal cells were co cultured and cell monolayers were established in a two chamber culture system. Trypsin (5 μM) was added to the apical chamber media and co cultures subjected to 90 minutes of hypoxia followed by reoxygenation. In some experiments, TA at 6.3 or 24 μg/ml was added to the basal ("systemic") chamber immediately following hypoxia. Human pulmonary microvascular endothelial cells (HMVEC) were then incubated with basal media supernatants obtained from the Caco-2/HT29-MTX groups. HMVEC apoptosis, permeability to FITC-albumin, ICAM-1 surface expression and syndecan shedding were measured. HMVEC were directly incubated with TA in other experimental subgroups.

Results: (mean ± SD, N = 4 for each group)

	%apoptosis	Perm. (nmol/cm^2/hr)	ICAM-1 (MFI)	Syndecan (ng/ml)
Caco-2/HT29-MTX sup.	4.4±0.5	0.32±0.02	9.9±1.1	26.2±0.5
Caco-2/HT29-MTX+tryp+H/R sup.	48.5±3.9*	2.10±0.08*	56.6±4.9*	98.9±8.2*
Caco-2/MTX+tryp+H/R sup.+TA direct(24 μg/ml)	41.7±4.1*	1.85±0.07*	50.7±4.5*	68.9±7.2*
Caco-2/MTX+tryp+H/R+TA(6.3 μg/ml)	10.8±1.6*#	0.60±0.04*#	20.1±1.9*#	48.7±3.5*#
Caco-2/MTX+tryp+H/R+TA(24 μg/ml)	9.6±1.3*#	0.52±0.05*#	18.2±2.2*#	30.6±3.8#

*p<0.001 vs. Caco-2/HT29-MTX sup., #p<0.001 vs. same group no TA and same group direct TA

Conclusion: Lung injury following exposure to non-bacterial factors associated with intestinal cell H/R was abrogated by treatment with TA. This was an "indirect" effect as it was associated with TA administration at only the intestinal cell level. A therapeutic window for TA administration following intestinal hypoxia was demonstrated in our study. These results support the concept that TA may have a protective anti-inflammatory effect following T/HS.

Poster # 76

THE PROGRESSION TOWARDS TIMELY AND COMPLETE HEMOSTATIC RESUSCITATION IN PENETRATING TRAUMA PATIENTS

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Introduction: Hemostatic resuscitation (HR) has been associated with improved outcomes in severe hemorrhage. Optimal implementation of HR in a comprehensive and timely manner (within the golden hour) requires an accurate identification of high-risk patients and a learning curve of the entire hospital team, in order to obtain the best possible results. We evaluated the effectiveness of achieving complete and timely HR over an 11-year period (2002-13) in penetrating trauma patients (PTP) at a level I trauma center.

Methods: PTP (≥16 years) who underwent damage control resuscitation were included. Patients were divided into four groups according to blood products transfused and time from admission to transfusion (TT) initiation.

Results: A total of 201 patients were included, mean age was 29 years (SD 10.38). Median systolic blood pressure was 90 [66.5 to 117.25], and base excess was -10.3 [-15 to -8]. Massive blood transfusion was required in 74 (36.8%) PTP. TT was 62 min [36-104] in complete HR (RBCs +Plasma+ PTL) group vs. 102 [55.2-164.7] in the other 3 groups ($p<.01$). When evaluating institutional practices before and after 2006, total 24/h crystalloids was 9782cc [5621-15563] vs. 5500cc [3793-8067 ($p<.01$)], complete HR was delivered in 16/52 (31%) vs.83/149 (56%) patients ($p=.003$), and mortality was 19/52 (36.5%) vs. 26/149 [17.4% ($p=0.008$)].

	RBCs+Plasma+PTL 1:1:1 n=99 (49.3%)	RBCs n=60 (29.9%)	RBCs+Plasma n=31 (15.4%)	RBCs+PTL n=11 (5.5%)
	Median [IQR]	Median [IQR]	Median [IQR]	Median [IQR]
RBCs	**6** [4 : 9]	2 [2 : 4]	4 [4 : 5.5]	5 [3 : 8]
TT RBCs	62 [36 : 104]	117 [66.5 :155.7]	64 [40 : 166.5]	80 [48.5 : 158.5]
Plasma	**6** [4 : 8]	...	4 [3 : 4.5]	...
TT Plasma	92 [64 : 145]	...	124 [70.5 : 192.5]	...
PTL	**6** [6 : 8,5]	...	...	6 [6 : 9]
TT PTL	95 [64.5 : 156]	...	...	95 [65.5 : 168.5]
TA	73 (73.7%)	21 (35%)	15 (48.4%)	7 (63.6%)
ISS	25 [20 : 34]	25 [16 : 29]	25 [16 : 34]	20 [17 : 25]
NISS	50 [34 : 50]	33 [23 : 41.2]	34 [25.5 : 50]	34 [26 : 44]
Mortality	28 (28.3%)*	11 (18.3%)*	4 (12.9%)*	2 (18.2%)*

RBCs: red blood cells, PTL: platelets, TT: time from admission to transfusion given in minutes, TA: tranexamic acid, *$p=0.2618$

Conclusion: Timely and complete HR was delivered to the most severe PTP (NISS≥50), with a mortality rate lower than similar matched NISS historical controls. Furthermore, this data showed that maturation in implementing HR is characterized by timely and efficient blood product delivery, decreasing crystalloid requirements and significantly improving outcomes in penetrating trauma at our institution.

Poster # 77

PREHOSPITAL PLASMA AND RED BLOOD CELLS TRANSFUSION IN TRAUMA PATIENTS

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Introduction: The evolution of remote damage control resuscitation for injured patients now allows for hemostatic resuscitation with packed red blood cells (RBC) and plasma in the prehospital environment at select trauma centers. We hypothesize that hemorrhaging trauma patients transfused in the prehospital environment with RBCs alone would have a greater mortality than combined plasma and RBC resuscitation.

Methods: IRB approval was obtained to study trauma patients' ≥18 years of age who had prehospital blood product resuscitation between 2002 and 2014. Prehospital plasma transfusion was implemented at the beginning of 2009. As appropriate, data is presented as means ± standard deviation, medians (interquartile range), or percentages with univariate analyses performed. A p-value <0.05 was considered significant.

Results: A total of 160 patients were identified of whom 86 (54%) received plasma and RBC transfusions and 74 (46%) received RBCs alone (mean age 47 ± 23 years; 64% male). Patients had 2.6 ± 1.1 units for plasma/RBC versus 1.2 ± 0.5 units for RBCs alone (p<0.0001). Patients were transfused with median of 7 (4-14) total blood product units in the plasma/RBC group compared to 3.5 (1-10.3) units in the RBC along group (p=0.0005). There was no difference between plasma/RBC versus RBCs alone in terms of Injury Severity Score (ISS; 23 ± 13 vs. 26 ± 14, p=0.1) or Glasgow Coma Scale (GCS; 9 ± 6 vs. 10 ± 6, p=0.6). Patients who received plasma/RBCs had shorter durations of hospital (10 ± 9 vs. 21 ± 31 days, p = 0.0005) and intensive care unit stays (4 ± 5 vs. 11 ± 15 days, p = 0.0001) but ventilator days were similar (5 ± 5 days vs. 6 ± 5 days, p=0.6). In-hospital mortality rates were comparable (16% vs. 9%, p=0.2). Further univariate analyses demonstrated that age, platelet count, blood pressure, ISS, and GCS were associated with in-hospital mortality but the use of plasma did not confer a mortality benefit **(Table)**.

Conclusion: The use of plasma for remote damage control purposes did not affect mortality. Ongoing prospective studies are warranted in the use of blood products for remote damage control resuscitation.

Table: Univariate analyses for variables associated with in-hospital mortality.

Variable	Odds Ratio (95% CI)
Age*	1.03 (1.01 to 1.05)
Female compared to male	1.42 (0.55 to 3.60)
Each calender year for admission (2002 to 2014)	1.11 (0.96 to 1.33)
Hemoglobin at admission (each g/dL unit increase)	0.90 (0.72 to 1.15)
Platelet at admission (each unit x 10^9/L increase)*	0.99 (0.98 to 0.99)
Systolic Blood Pressure*	0.97 (0.96 to 0.99)
Heart Rate	0.99 (0.97 to 1.00)
Injury Severity Score*	1.07 (1.03 to 1.11)
Glasgow Coma Scale*	0.83 (0.73 to 0.91)
Plasma use	1.86 (0.73 to 5.17)
Per unit transfused in a prehospital setting	1.30 (0.87 to 1.79)
*indicates a statistical significance at a p-value <0.05	

Poster # 78

OBESITY-RELATED ADIPOSOPATHY CONTRIBUTES TO A HYPERCOAGULABLE STATE FOLLOWING TRAUMA

Robert D. Winfield MD, Isaiah R. Turnbull MD,Ph.D., Anja Fuchs Ph.D., Sarbani Ghosh MS, Christopher Davis BS, Grant V. Bochicchio* MD,MPH, Washington University School of Medicine

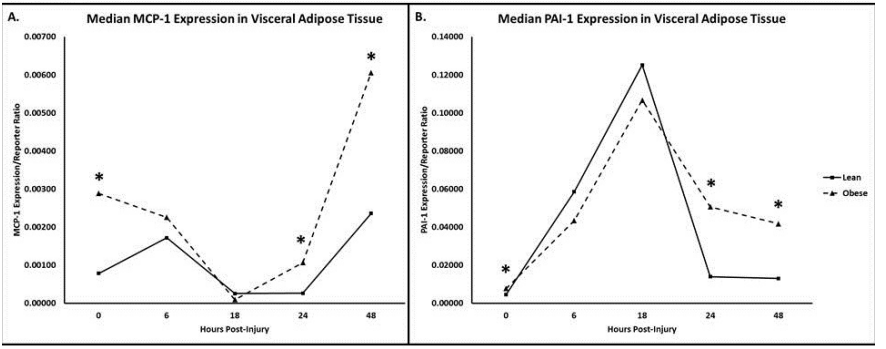
Introduction: In animal models and in retrospective human series, obesity has been found to correlate with diminished coagulopathy following trauma and greater rates of postinjury thromboembolic events. Obesity is associated with dysfunctional changes in adipose tissue known broadly as adiposopathy, which includes increased expression of the pro-inflammatory, procoagulant factors MCP-1 and PAI-1. We hypothesized that obesity-related adiposopathy would contribute to a hypercoagulable state following polytrauma insult.

Methods: Cohorts of male C57Bl/6J mice (n=6-18) were raised to 20-22 weeks of age. Obesity was induced utilizing a diet consisting of 60% kcal fat while control animals were raised on a diet with 10% kcal fat. Upon reaching appropriate age, animals were subjected to polytrauma (hepatic laceration, pseudofracture (proximal hindleg soft tissue crush injury followed by injection of isogenic bone homogenate), and 15% hemorrhage). At a series of time points pre- and post-injury, adipose tissue and blood were collected from animals for assessment of subcutaneous and visceral adipose tissue expression of procoagulant factors (PAI-1 and MCP-1) measured by RT-qPCR as well as these same factors measured in plasma via ELISA or multiplex assay.

Results: Obese animals were significantly heavier than controls (39 vs 29 gm, $p<0.001$). In subcutaneous adipose tissue, obese animals were noted to have elevated baseline expression of PAI-1 followed by persistently elevated PAI-1 expression at 24 hours and beyond (not shown). MCP-1 expression in subcutaneous adipose did not differ between cohorts . In visceral adipose, obese animals showed significantly elevated levels of both MCP-1 and PAI-1 at baseline followed by persistent and significant elevations in expression of these mediators at 24 hours and beyond (Figure 1). There were no significant differences seen between groups in plasma levels of PAI-1 or MCP-1 across the time period studied.

Conclusions: Obese animals display greater adipose tissue expression of MCP-1 and PAI-1 at baseline and persistently elevated expression of these procoagulant mediators following trauma. These data suggest that obesity-related adiposopathy contributes to a hypercoagulable state which is protective in the early post-injury period but which leads to venous thromboembolism in the long term. The absence of a differential increase in procoagulant factors in circulation indicates that hypercoagulability in obesity following trauma may be mediated through local interactions between adipose tissue and the vasculature.

Figure 1.



Poster # 79

FIELD INTUBATIONS OF CIVILIAN PATIENTS WITH HEMORRHAGIC SHOCK IS ASSOCIATED WITH HIGHER MORTALITY

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Introduction: Field intubation (FI) by Emergency Medical Services personnel on severely injured trauma patients remains a contentious practice. Clinical studies suggest an association between FI and adverse outcomes in patients with traumatic brain injury (TBI) and military tactical emergency casualty care recommends deferring intubation and providing supplemental oxygenation. Animal models with penetrating hemorrhagic shock demonstrate increased acidosis with intubation prior to resuscitation. The purpose of this study was to evaluate the impact of FI on outcomes in trauma patients with hemorrhagic shock requiring massive transfusion.

Methods: The Los Angeles County Trauma System Database was retrospectively queried for all trauma patients ≥ 16 years of age with hemorrhagic shock requiring massive transfusion (≥ 6 units PRBCs in the first 24 hours) between 2012 and 2014. Demographics, clinical and transfusion data, and outcomes were compared between patients who received FI and those who did not (NO-FI). Multivariate regression analysis was utilized to identify independent predictors of mortality.

Results: Of 552 trauma patients meeting inclusion criteria, 63 (11%) received FI and the remaining 489 (89%) were NO-FI. Mean age, gender, and blunt trauma were similar between FI and NO-FI. FI patients had a lower mean GCS (4 v. 10, $p<0.001$), a lower mean SBP (76 v. 104 mmHg, $p=0.001$), and a higher mean ISS (41 v. 31, $p<0.001$). Mortality was higher in FI patients (83% v. 43%, $p<0.001$). Transfusion patterns and scene time were similar in both groups. Multivariate analysis identified FI as a predictor of higher mortality (AOR: 3.7, CI 95% 1.7-8.0, p<0.001).

Conclusion: Field intubation is associated with higher mortality in trauma patients with hemorrhagic shock requiring massive transfusion. Less invasive airway interventions and rapid transport should be encouraged in this population.

	Field Intubation n=63	No Field Intubation n=489	*p*-value
Age (years)	35.1 ± 16.6	39.2 ± 18.2	0.090
Age ≥ 65 (years)	4.8%	10.2%	0.166
SBP ≤ 90 (mmHg)	51.7%	34.7%	**0.011**
ISS ≥ 16	95.2%	87.5%	0.072
MTP Activation	87.3%	71.4%	**0.021**
PRBCs in 24h (units)*	18.0 ± 13.6	17.6 ± 27.7	0.917
FFPs in 24h (units)*	7.6 ± 7.6	7.4 ± 8.2	0.898
Platelets in 24h (units)*	1.4 ± 1.8	1.5 ± 1.8	0.549
Cryo in 24h (units)*	0.5 ± 1.2	0.3 ± 0.6	0.254
Total Blood Products in 24h (units)*	23.7 ± 18.4	25.0 ± 21.5	0.641
Hospital LOS (days)	7.1 ± 12.6	18.1 ± 23.4	**<0.001**
ICU LOS (days)	10.1 ± 12.3	11.0 ± 13.6	0.721
Scene Time (min)	10.0 ± 7.5	10.6 ± 6.5	0.351
Mortality	82.5%	43.1%	**<0.001**

*1 unit = 350 mL

Poster # 80

REBOA Responder (IABO Responder) with Traumatic Hemorrhagic Shock who failed Fluid Resuscitation (Fluid Non-responder) could be Possible to Rescue

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Introduction: Fluid resuscitation and massive transfusion protocol (MTP) are important and effective strategy as initial resuscitation for traumatic hemorrhagic shock. But sometimes those who were not preferable response to them (Fluid Non-responder) are difficult to rescue. In such cases, resuscitative open aortic cross clamping or resuscitative endovascular balloon occlusion of the aorta (REBOA) would be performed as a temporary hemostasis treatment. But it is still unclear what cases is more effective and can rescue with REBOA. So we studied the relationship between the responsiveness to fluid resuscitation and REBOA.

Methods: Of 27209 trauma patients transported to our emergency and trauma center for last seven years, consecutive 42 patients underwent REBOA as a first-line resuscitation were included. All included patients were in traumatic hemorrhagic shock and focused assessment with sonography for trauma (FAST) were positive. 10Fr or 7Fr intra-aortic balloon occlusion (IABO) catheter kits were inserted at the supraphrenic level with Seldinger technique and ultrasonography guided method. And all of them were underwent fundamental hemostasis by operative management (OM) or transcatheter arterial embolization (TAE). They were sorted into responded group or non-responded group for REBOA. The primary end point was a survival rate in 30th days. Secondary end points were the complications with REBOA or IABO devices.

Results: 10 transient-responded patients for fluid resuscitation and 12 fluid non-responded patients were responded for REBOA (REBOA Responder group). 20 non-responded patients for fluid were not responded for REBOA (REBOA Non-responder group). There were no significant differences between age (REBOA Responder vs. Non-responder : 41.8 vs 49.2), rate of blunt trauma (19/22 (86%) vs. 18/20 (90%)), ISS (45.8+/-13.8 vs. 56.5+/- 21.8), amount of total fluid therapy (9225+/-7285ml vs. 7898+/-3590ml), rate of OM (17/22 (77%) vs. 17/20 (85%)), rate of TAE (10/22 (45%) vs. 5/20 (25%)) and total occlusion time by IABO device (53.6+/-31.2min vs. 72.8+/-26.8min). There were significant difference in the changes of systolic blood pressure before and after of REBOA (62.5+/-31.2mmHg vs. 28.3+/-33.9, $p=0.03$) and in the mortality (4/22 (18%) vs. 20/20 (100%), $p<0.01$). There were two complications (leg ischemia and aortic dissection) in REBOA Responder group but were not lethal.

Conclusion: The traumatic hemorrhagic shock patients with Fluid Non-responder, but Responder for REBOA could be possible to rescue.

Poster # 81

CLINICAL INDICATORS OF HEMORRHAGIC SHOCK DURING PREGNANCY

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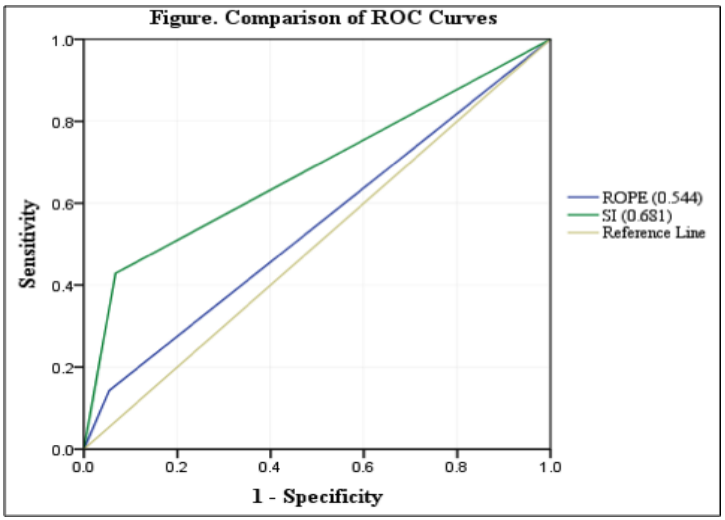
Background: During pregnancy, normal physiologic changes occur that often make it difficult for the clinician to recognize hemorrhagic shock. Several hemodynamic parameters have been promoted to help establish the diagnosis in trauma patients, but none have been validated in the pregnant population. The objective of this study was to compare the abilities of three different measures of shock to predict blood transfusion requirements among pregnant trauma patients.

Methods: This study included 81 pregnant trauma patients admitted to a high-volume trauma center (2010-2015). In separate logistic regression models, we tested the relationship between exposure variables – initial Systolic Blood Pressure (SBP), Shock Index (SI), and Rate Over Pulse Evaluation (ROPE) – and the outcome of transfusion of blood products within 24-hours of admission. To demonstrate the ability of each measure to predict the outcome, we compared dichotomous exposure variables (with cutoff points: SBP ≤ 90, SI > 1, and ROPE > 3) using Receiver Operating Characteristic (ROC) curves.

Results: A total of 10% of patients received blood products in the patient cohort.No patients had an initial SBP < 90, so that measure was excluded from analysis. We found that patients with SI > 1 were significantlymore likely to receive blood transfusions compare with patients with SI < 1 (OR = 10.35, CI 95% 1.80 – 59.62), whereas ROPE > 3 had no significant association with blood transfusion compared with ROPE < 3 (OR = 2.92, CI 95% 0.28 – 30.42). Furthermore, comparison of area under the ROC curve for SI (0.68) and ROPE (0.54) suggested that SI was more predictive than ROPE of blood transfusion.

Conclusion: Our findings demonstrated that SI detected hemorrhagic shock more effectively than both SBP and ROPE in pregnant patients. These results should prompt further research to validate our findings in a larger patient population.



Poster # 82

FORCED-CHOICE BLOOD TRANSFUSION ORDERS REDUCE TRANSFUSIONS IN CRITICALLY INJURED PATIENTS

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Introduction: We examined the effect on blood usage of a new order set requiring selection of specific criteria for each red blood cell (RBC) unit (U), plasma (FFP), & platelet (P) transfusion (TX). **Methods:** TX data prospectively collected on Trauma ICU patients (pts), & compared for 12 mos. before (Pre) and 8 mos. after (Post) the order set started in April 2014. Criteria for RBC TX: 1U only for hemoglobin (Hgb) <7mg/dl in stable patients or <8 with angina, MI, cardiogenic shock; 2U if Hgb <5; multiple U if shock, hypotension, bleeding. Massive TX pts were excluded. Differences in demographics & outcomes Pre and Post were assessed with Student's *t* test, Wilcoxon-Mann Whitney test (continuous) and χ^2 test (categorical). The % pts with TX over time was compared with trend tests. Severity of illness (SOI) was graded from 1 (minor) to 4 (extreme). **Results:** Of 1,076 TICU pts (604 Pre, 472 Post), 244(23%) had a TX. Mean SOI was similar for TX pts (Pre 3.5±0.7 v. Post 3.4 ± 0.8, p=0.267).The percentage of pts getting TX (Fig.) decreased for all TX, RBC, & FFP. RBC TX overall, and RBC U per patient dropped by almost 50%. Pre & Post mortality (17% v.15%, p=0.44), and % blunt trauma (91 v. 93, p=0.32) were the same. Infections were lower in the Post group (3.3% v. 1.5, p=0.057). **Conclusions:** A significant reduction in RBC TX & incidence of TX was seen with forced-choice orders and strict selection criteria

TRANSFUSIONS	**PRE** n(mean ±SD)	**POST** n(mean ±SD)	**p-value**
% All patients TX'd	***162 (26.8%)***	***82 (17.4%)***	***<0.001***
% transfused FFP	***68 (11.3%)***	***32 (6.8%)***	***0.012***
% transfused platelets	47 (7.8%)	29 (6.1%)	0.298
% transfused RBC	***130 (21.5%)***	***53 (11.2%)***	***<0.001***
All units TX'd	100.8 ± 54.5	61.9 ± 47.0	0.117
FFP	28.2 ± 19.7	20.4 ± 22.7	0.425
Platelets	6.0 ± 4.6	5.4 ± 3.2	0.744
RBC	***66.6 ± 32.9***	***36.1 ± 22.9***	***0.036***
All U TX'd per patient	***2.0 ± 6.4***	***1.0 ± 5.0***	***0.006***
FFP	0.6 ± 2.3	0.4 ± 2.1	0.114
Platelets	0.1 ± 0.5	0.1 ± 0.5	0.350
RBC	***1.3 ± 4.1***	***0.6 ± 2.8***	***0.001***
U per patient getting TX	7.5 ± 10.6	6.0 ± 10.7	0.323
FFP U per pt TX'd	5.0 ± 5.2	5.1 ± 6.5	0.919
Platelet U per pt TX'd	1.5 ± 1.0	1.5 ± 1.4	0.866
RBC U per pt TX'd	6.2 ± 6.9	5.5 ± 6.5	0.532

Poster # 83

MODULATING THE BIOLOGIC ACTIVITY OF MESENTERIC LYMPH AFTER TRAUMATIC SHOCK DECREASES SYSTEMIC INFLAMMATION AND END ORGAN INJURY

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Introduction: Trauma/hemorrhagic shock (T/HS) causes the release of gut-derived pro-inflammatory mediators into the mesenteric lymph (ML) triggering a systemic inflammatory response and acute lung injury (ALI). We have previously shown that both electric and pharmacologic vagal nerve stimulation prevent gut barrier failure and alter the biologic activity of the ML after injury. We hypothesized that treatment with a pharmacologic vagal agonist after T/HS would attenuate the biologic activity of ML and prevent ALI.

Methods: Male Sprague-Dawley Rats underwent cannulation of the mesenteric lymph duct prior to T/HS or trauma-sham shock (T/SS). A separate cohort of animals was treated with the pharmacologic vagal agonist CPSI-121 (1mg/kg) during resuscitation with shed blood and normal saline. ML samples from each experimental group were injected into naïve mice to assess biologic activity. Pre- and post-infusion blood samples were analyzed for changes in STAT3 phosphorylation (pSTAT). Lung injury was characterized by histology and permeability. Changes in immune cell recruitment to the lung after the injection of ML were characterized using flow cytometry.

Results: T/HS lymph injected in naïve mice caused a systemic inflammatory response characterized by hypotension and increased monocyte pSTAT. Injection of T/HS lymph caused ALI confirmed by histology and increased lung permeability. Mice injected with T/HS + CPSI-121 lymph had stable hemodynamics and monocyte pSTAT levels similar to the animals injected with lymph from the T/SS group. CPSI-121 attenuated T/HS lymph-induced ALI based on histology and lung permeability data, which were similar to T/SS. There was an increase in the recruitment of pulmonary macrophages to the lung after injection of lymph from T/HS animals, which was attenuated in mice injected with lymph from animals treated with CPSI-121 after T/HS.

Conclusion: Treatment with CPSI-121 after T/HS attenuated the biologic activity of the ML and decreased acute lung injury. Given the superior clinical feasibility of utilizing a pharmacologic approach to vagal nerve stimulation, CPSI-121 is a potential treatment strategy to limit end organ dysfunction after injury.

Poster # 84

COMPARISONS OF FFP AND PRBC RESUSCITATION ON OXYGEN METABOLISM AND COAGULATION FOLLOWING FEMUR INJURY AND SEVERE HEMORRHAGE IN PIGS

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Introduction: Damage control resuscitation strategy reducing crystalloid use and higher plasma to red blood cell ratios has been increasingly accepted and implemented in US trauma centers, but the metabolic responses of these resuscitation approaches remain unclear. This study compared resuscitation effects of LR, FFP alone, or PRBC+FFP on oxygen metabolism and coagulation in pigs with traumatic injury and hemorrhagic shock.

Methods: Femur fracture was induced in 21 pigs (40±1kg) using the captive bolt stunner at midshaft of the left legs of the pigs, followed by a hemorrhage of 60% estimated total blood volume (42 ml/kg). Pigs were then randomized to be resuscitated with either FFP (1x bled volume, n=7, FFP group), 1:1 ratio of FFP (21 ml/kg) and PRBC (21 ml/kg, n=7, PRBC+FFP group), or LR (3x bled volume, n=7, LR group). FFP and PRBC were made from matching donor pigs on the day prior to the study day. Pigs were monitored for 6h. Arterial and venous blood samples were taken at baseline (BL), 15 min, and 6h after the completion of resuscitation for measurements of oxygen metabolism and coagulation.

Results: BL measurements were not different between the groups. MAP has decreased to 50% of BL by the 60% hemorrhage but recovered close to BL and HR has increased but recovered close to BL after resuscitation in all groups. Compared to FFP alone, resuscitation with PRBC+FFP resulted in higher Hct, platelet count, oxygen delivery (DO_2); lower oxygen demand ($DemO_2$); and higher ratio of $DO_2/DemO_2$ (all $p<0.05$, see table), with no differences in fibrinogen levels, BE, or oxygen consumption. Clot strength (TEG-MA) was maintained by FFP alone or with PRBC (BL 71±1mm), but no recovery shown in LR until at 6h ($p<0.05$, see table). There were no differences in other TEG parameters.

Conclusions: Compared to LR, resuscitation with FFP alone or with PRBC (1:1) maintains coagulation. But similar to LR, FFP does not provide the benefit of correcting oxygen debt of PRBC+FFP. These data suggest that 1:1 ratio of FFP:PRBC sustains oxygen metabolism further than FFP or LR alone in early resuscitation for severe hemorrhage.

	MA (mm)		Lactate (mM)		Cardiac Output (L/min)		$DO_2/DemO_2$	
	15 min	6h	15 min	6h	15 min	6h	15 min	6h
LR	64±2	69±2	10±1	6±1	4.6±0.4	3.1±0.2	0.6±0.1	0.7±0.1
FFP	74±1	76±1	9±1	3±0	6.5±0.2	4.5±0.2	0.8±0.0	0.9±0.1
PRBC+FFP	70±1	72±2	8±1	1±0	4.4±0.5	2.7±0.2	1.3±0.1	1.5±0.1

Poster # 85

CAN IT GET EASIER THAN ABC?: A SEE "SI" FILE

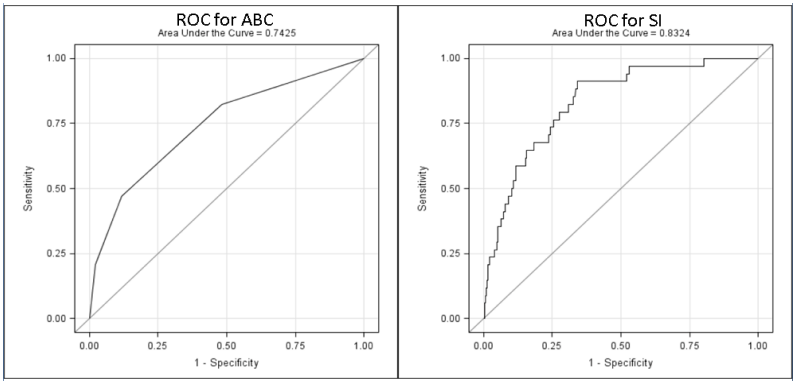
Jiselle B. Heaney MD,MPH, Rebecca Schroll MD, David Swift BS, Stuart Couch BA, Marquinn Duke MD, Norman McSwain* Jr., MD, Juan Duchesne* MD, Tulane School of Medicine

Introduction: Various scoring systems have been developed to predict need for massive transfusion in traumatically injured patients. Assessments of Blood Consumption (ABC) score and Shock Index (SI) have been shown to be reliable predictors for massive transfusion, defined as transfusion of >10 units packed red blood cells (PRBC). However, no study has compared these two scoring systems to determine which is a better predictor for massive transfusion. Primary objective was to determine if ABC or SI better predicts the need for massive transfusion in trauma patients.

Methods: Retrospective cohort design included all injured patients who required trauma activation between January 1, 2009 and December 31, 2013 at an urban level 1 trauma center. Patients <18 years old or with traumatic brain injury (TBI) were excluded. ABC and SI were calculated for each patient and compared. Ability to predict need for >10 units PRBC transfusion within the first day was calculated. Sensitivity, specificity, and area under the receiver operating characteristic curve (AUROC) were used to evaluate scoring systems.

Results: There were 645 patients that had complete data for analysis. Shock Index ≥1 had sensitivity of 67.7% and specificity of 81.3% for predicting transfusion of >10 units PRBC and ABC score ≥2 had sensitivity of 44.3% and specificity of 92.3%. AUROC analyses showed the strongest predictive value was SI followed by ABC score with area under the curve values of 0.83, and 0.74 respectively. SI had a significantly greater sensitivity (P=0.035), but a significantly weaker specificity (P<0.001) compared to ABC score.

Conclusion: ABC score and Shock Index can both be used to predict need for massive transfusion in trauma patients, however SI is a more accurate predictor and also requires less technical skill than ABC score.



Poster # 86

EXSANGUINATION SHOCK IN THE COMBAT ZONE

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Introduction: Although significant research has been dedicated to combat casualty care and improvement in mortality, little data exist on the cohort of combat casualties presenting with severe hemorrhagic shock. The goal of this study was to prospectively evaluate combat casualties with initial systolic blood pressures (SBP) ≤90 in order to delineate the differences in patients able to be successfully resuscitated with those who died from exsanguination.

Methods: All traumatically injured combat casualties arriving to a role 3 Combat Support Hospital (CSH) with initial SBP ≤90 from Jan 2012 –June 2014 were enrolled in this multicenter prospective observational study. Data was prospectively collected by on-site research staff including patient demographics, pre-hospital interventions, vital signs, laboratory values, surgical procedures, blood transfusions, and outcomes. Standard descriptive statistical methods were used; any categorical variables were compared via Chi-Squared and Fisher's exact test while continuous variables were compared via Student's t-test or Wilcoxon test as appropriate.

Results: 104 patients arrived to a level 3 CSH with SBP ≤90 and 30-day mortality was 33%. Those who died were more likely to have required cardiopulmonary resuscitation (CPR) and/or an emergency department thoracotomy (EDT) (74% and 44%, respectively; $p<0.001$). Hypotensive casualties who survived had a higher relative SBP, heart rate, hematocrit, pH, and a lower base deficit ($p<0.0001$). Blood products transfused in both survivors and non-survivors were similar with a majority receiving balanced hemostatic resuscitations. The most common etiology of death per physicians was exsanguination (66%), head injury (20%), and cardiac failure (6%). The median time of death was approximately 8 hours with 40% of all deaths occurring in the first 24 hours.

Conclusion: Hypotensive combat casualties receiving CPR on arrival were more likely to die (96%) as were patients requiring an EDT ($p<0.0001$). The temporal distribution of deaths showed that if a patient survives the first 24 hours of admission, they have a greater than 90% survival rate. Combat casualties arriving hypotensive and/or pulseless to surgical facilities have a significant expected mortality. While trauma care has largely improved in the combat setting, these data show we still need improvement in pre-hospital care and targeting ways to increase survival in those presenting with exsanguination shock.

Poster # 87

CAN OPTICAL MICROSCOPY DETECT MITOCHONDRIAL CHANGES FOLLOWING CRYSTALLOID RESUSCITATION OF HEMORRHAGIC SHOCK?

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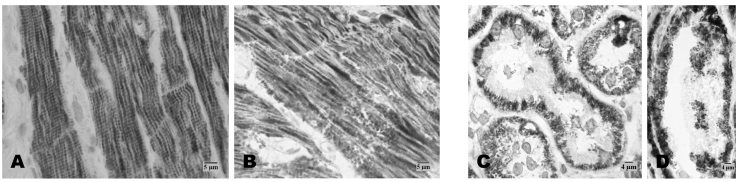
Introduction: During hemorrhagic shock, mitochondria swell and their enzymatic activity diminishes. These changes have already been documented with the use of electron microscopy. However, for large volumes of specimens, a faster and less expensive method such as optical microscopy (OM) is desirable. To date, the literature on mitochondrial changes during shock, as observed under the OM, is scarce. Furthermore, there is a lack of studies on the *in situ* activity of Cytochrome C Oxidase (COX), an enzyme that exists only within mitochondria. The aim of this study was to fill in these two gaps; we tried to use optical microscopy to determine the histological changes of COX-stained rat tissues following hemorrhagic shock treated with fluid replacement.

Methods: 17 male Wistar rats were allocated to three groups: sham (n = 2), control (only surgery, n = 4) and normal saline (NS) group (bleeding, treated with NS, n = 11). Hemorrhagic shock was established by exsanguination to a mean arterial systolic blood pressure of 40 mm Hg for 60 minutes. After shock, the rats received NS, (twice the volume of blood removed). Rats were sacrificed 24 hours later and snap frozen tissue biopsies from heart and kidney were obtained, stained for COX, and examined via OM.

Results: **Heart: Normal** (Fig. A)**:** Three mitochondrial populations can be identified: perinuclear, sub-sarcolemmal and interfibrillary (IF) mitochondria; a regular striation pattern can be noted. **Control:** minimal inter- and intra-cellular edema and rare contraction bands. **Shock** (Fig. B)**:** Inter- and intra-cellular edema is more pronounced and depends on the volume of NS infused. Dissolution of the perinuclear mitochondria, accentuation of sub-sarcolemmal mitochondria, and loss of striations. **Kidney: Normal** (Fig. C)**:** Densely packed oblong mitochondria in the infranuclear part of the tubular cells can be observed; different tubules can be identified according to COX activity patterns. **Control:** Minimal to no edema. **Shock** (Fig. D)**:** Swollen mitochondria, acute tubular necrosis and extracellular edema. Inter- and intra-cellular variability in COX activity was minimal in all **normal cells** and increased in all **cells in shock**.



Conclusion: Crystalloid resuscitation of hemorrhagic shock in rats precipitates mitochondrial changes in cardiac myocytes and renal tubular cells that can be observed with OM. The severity of these changes depends on the volume of crystalloid infusion. Although the diagnosis of shock does not depend on microscopic analysis, the method outlined herein is simple and can be used to quickly and inexpensively analyze the severity of shock at the cellular level; this method can also be used to evaluate the histologic effects of experimental treatments.

Poster # 88

A CLOSER LOOK AT TXA: EXAMINING UTILIZATION AND OUTCOMES

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Introduction: Several studies have shown an increased survival benefit in trauma patients at risk of significant hemorrhage who receive TXA. Administration of TXA, however, is ultimately dependent on the trauma team leader's clinical discretion and may therefore be underutilized. We hypothesized that use of a visual prompt (VP) would improve the utilization of TXA and that TXA use would result in a decreased mortality.

Methods: All trauma activations in a regional Level 1 trauma center over a 29 month period ending in September, 2014 were reviewed. TXA was administered to all patients at risk of significant hemorrhage at surgeon discretion. A VP in the form of a sticker placed on the blood bank cooler was implemented 13 months after the introduction of TXA at our center. Data were analyzed using student's t-test, Chi square analysis and multivariate logistic regression.

Results: There were 3744 trauma activations during the study period. Seven hundred fifty six patients met criteria for administration of TXA based on need for blood transfusion in the ED and/or SBP <90. Of this population, the average age was 37, 78% were male, 44% were penetrating trauma, with an average ISS of 20.2 (SD +/- 11.6) and an overall mortality 22%. Immediate operative intervention was performed in 45% and 92% had a transfusion requirement while in the ED. Of the patients who met criteria for TXA, 89 (12%) received it and only 12 patients received both doses. Implementation of the VP increased utilization of TXA from 9% to14% ($p = 0.026$, OR 1.7, 95% CI 1.085-2.702). There was no statistically significant difference in the development of VTE in the patients who received TXA versus those who did not. The group who received TXA had significantly higher ISS scores (25 vs 20, $p<0.0001$) and significantly higher overall mortality (32% vs 20%, $p=0.013$, 95% CI 1.160-2.624) but there was no difference in 24 hour mortality. However, multivariate analysis showed TXA had no association with increased mortality ($p=.421$, 95% CI 0.644-2.870).

Conclusion: TXA utilization is a challenge in our trauma population. Implementation of a VP improved utilization of TXA but had no effect on administration of the second dose. Patients who did receive TXA had a significantly higher mortality rate but also a significantly higher ISS. Further analysis demonstrated that this was not attributable to TXA but rather due to selection bias for more severely injured patients. The high acuity in our patient population, as evidenced by the high ISS, mortality rate and use of blood transfusions, also suggests significant underutilization of TXA in a population that meets clinical criteria.

Poster # 89

EFFECT OF TIME TO OPERATION FOR GSW AFFECTS MORTALITY: THE GOLDEN 10 MINUTES

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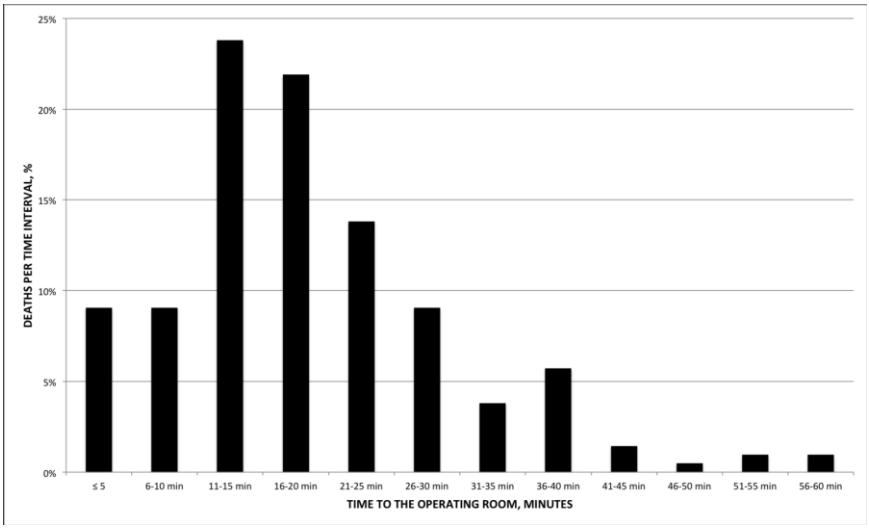
Introduction: Optimal timing from ED arrival to operation for GSW is not established. Hemorrhagic shock leads to early death from bleeding or late death from MSOF. We hypothesized that time spent in the ED increases all cause mortality in GSW.

Methods: Registry review at a level 1 TC. Patients ≥18 years with GSW requiring operation directly from ED to OR from 01/2004-09/2013 were included; exclusions were TBI, transfer from outside institution, & >1 hour to OR.

Results: 975 patients were included (age 31.2±11.9 years, 92% male, ISS 22±15, HR 95±36, SBP 109±46, GCS 13±4, & BD -6±8 mEq/L). Mean time to OR was 20±13 min. Overall mortality was 22%. Patients were divided into 5-minute intervals up to one hour from arrival to the ED. Mortality increased with time to OR up to 10-15min, then decreased. The ≤15min group and >15min group were similar in age, HCT, HR, SBP, GCS, and ISS. A more severe base deficit (BD) was seen in the >15min group (6 vs. 5, p=0.04). The dose of time leading to a 50% cumulative mortality (L T50) was 17 minutes.



Conclusion: Patients with GSWs that require operative intervention should be taken to the OR expeditiously (LT50=17min). The >15min group appears to have decreasing mortality due to a survival bias, despite worse BD. Protocols should be designed to shorten ED time.

Poster # 90

PROGNOSIS OF PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY WITH GLASGOW COMA SCALE OF 3 IS PREDICTED BY SIMPLE CRITERIA KNOWN ON ED ARRIVAL

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Introduction: Severe traumatic brain injury (TBI), commonly defined as a Glasgow coma scale (GCS) score of 3-8, accounts for approximately 9% of TBI injuries. Prognosis in the most severe patients presenting with GCS 3 is grim, with mortality in some series approaching 100%. Difficulties in prognosis lie in the population heterogeneity; prior studies are largely represented by transportation-related TBI, whereas now several cohorts of TBI have emerged, including elderly falls from low height. Our purpose was to examine the prognosis of patients with TBI and GCS 3 across the following injury cohorts: vehicular, fall, sporting, assault, gunshot wound (GSW), and other injuries (blast, crush, explosion, suicide attempt).

Methods: We identified patients with TBI (ICD-9-CM diagnosis of 851.0-854.2) presenting to the ED with a GCS 3 between 2009-2013 using trauma registry data at three trauma centers (2 L1, 1 L2); there were no exclusions. We used chi-square and multivariate stepwise logistic regression analyses to compare injury cohorts for the following outcomes: in-hospital mortality, favorable disposition defined as discharge to home or rehabilitation, and development of a complication.

Results: There were 663 patients with severe TBI presenting with a GCS 3: vehicular accidents (46%), falls (31%) and sporting injuries (12%) were most common. Outcomes were as follows: 41% mortality, of which 8% were DOA and 10% died in the ED; 45% favorable disposition to home or rehabilitation (75% favorable among survivors); 42% developed a complication. Mortality was significantly different by injury cause, and was greatest in GSW reaching 100% (table). Favorable disposition was also significantly different by injury cause, and was greatest in sporting and assault injuries, where two-thirds were discharged home or to rehabilitation (table). Complications were significantly lower in GSW injuries likely due to survival bias; otherwise complications were similar in all other injury groups (p=0.50). Independent predictors of survival included concussion (OR: 17.2 (4.0-74.9), younger age < 65 (OR: 4.8 (2.1 – 11.0), and normal ED vital signs (OR: 3.4 (1.9-6.2), p <0.001 for all. However, only in vehicular injuries did mortality differ in those with normal vs. abnormal ED vital signs (26% vs. 49% mortality, p < 0.001); in all other causes of injury ED vital signs were not prognostic.

Conclusion: Despite being classified as severe TBI using GCS 3 criteria, there was high survival as well as favorable disposition to home or rehabilitation among survivors in certain injury cohorts. Thus, suspicion (and confirmation) of TBI and presentation with GCS 3 are not universally indicative of poor prognosis. Clinicians may be able to use limited information upon ED arrival, such as age, vital signs and cause of injury, to help determine likelihood of survival to discharge and favorable discharge disposition.

Table. Characteristics of the TBI population with GCS 3, by cause of injury

Covariate / Outcome %	Vehicular (n=311)	Fall (n=195)	Sporting* (n=81)	Other** (n=28)	Assault (n=27)	GSW (n=21)	P value
Age ≥ 65	14%	43%	16%	7%	7%	5%	**<.001**
Concussion as only TBI	17%	5%	21%	0%	33%	0%	**<.001**
Abnormal vital sign in ED	58%	41%	53%	61%	41%	76%	**0.001**
In-hospital mortality	39%	46%	19%	57%	22%	100%	**<.001**
Development of a complication	45%	37%	43%	36%	41%	10%	**0.03**
Disposition: home or rehabilitation	48%	34%	67%	29%	67%	0%	**<.001**

*Ski, snowboard, snowmobile, ATV, horse, bike, boating injuries; **Blast, crush, explosion, suicide attempt

Poster # 91

Conscious status is associated with the likelihood of trauma center care and mortality in patients with moderate to severe TBI

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Background: Studies of patients with traumatic brain injury (TBI) conducted using administrative data frequently detect greater mortality among individuals treated in trauma center (TC) vs. non-trauma center (NTC) hospitals, even after controlling for anatomical injury severity. Most such studies have not accounted for patient consciousness. We investigated whether patient conscious status as derived from ICD-9-CM diagnosis codes in a large administrative dataset, was differentially associated with treatment at a TC vs. NTC as well as with in-hospital mortality among patients with moderate-to-severe TBI.

Methods: The Nationwide Emergency Department Sample (NEDS) from 2006-2011 was queried and all patients meeting CDC criteria for TBI were identified. Body region-specific Abbreviated Injury Scale (AIS) scores and loss of consciousness (LOC) (dichotomized as no/brief vs. extended > one hour) were computed for each patient from ICD-9-CM classifications and modifiers. Patients with isolated head/neck AIS scores ≥3 were included and those with undefined/unidentified LOC status were excluded. Level 1 and 2 trauma centers were classified as TC and non-trauma center hospitals as NTC, patients at level 3 trauma centers or in collapsed categories that included level 3 centers were excluded. Primary outcomes examined included likelihood of TC vs. NTC treatment and in-hospital mortality. In analyses stratified by age (<65 vs. ≥65 years), multivariable logistic regression (MLR) models controlling for gender, age, mechanism of injury, Charlson comorbidity index, insurance status and AIS were compared with identical models that also included LOC.

Results: A total of 66,636 patients with isolated TBI were identified, of whom 15,761 (23.6%) were excluded for missing LOC status. Among the remaining 50,875 patients, 59.0% were male, 54.0% were ≥65 years old and 56.7% were treated in a TC. Overall, 27.3% of patients had extended LOC. Patients with extended LOC were proportionally more likely to be treated in a TC vs. those with no/brief LOC (71.1% vs. 51.4%, p<0.001). As anticipated, treatment at a TC vs. NTC was associated with increased odds of mortality among younger patients [OR 1.91 (unadjusted) vs. 1.84 (MLR)], however accounting for LOC significantly mitigated this relationship [OR 1.25 (MLR adjusted for LOC)]. Similar between-model differences were also observed among older patients; however the TC vs. NTC effect size was reduced.

Conclusion: Patients with extended LOC were more likely to be treated at TCs and more likely to die than similarly injured individuals at NTCs after accounting for injury-related and patient-level factors. Accounting for patient LOC reduced the observed difference in odds of mortality between TC and NTC facilities by 70%. These findings suggest that measures of consciousness should be included when assessing TBI outcomes using administrative databases.

Odds of mortality comparing TC vs. NTC, stratified by age group

	Unadjusted [1]			Adjusted, excluding LOC [2]			Adjusted, including LOC [3]		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Young adult (18-64)	1.91	1.74 , 2.08	<0.001	1.84	1.64 , 2.08	<0.001	1.25	1.11 , 1.43	<0.001
Old adult (65+)	1.55	1.44 , 1.66	<0.001	1.43	1.32 , 1.55	<0.001	1.22	1.13 , 1.33	<0.001

1; crude odd ratio
2; adjusted for age, gender, AIS, mechanism of injury, Charlson Index, insurance status
3; adjusted for age, gender, AIS, mechanism of injury, Charlson Index, insurance status + LOC

Poster # 92

BAD DEBT AND GOOD BILLING: FINANCIAL BURDEN RISKS AND RELIEF

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Introduction: An unexpected financial burden is part of the cost of trauma care. Insurance and grant programs have been designed to help alleviate this burden, but many patients are not aware of financial assistance options. The burden resulting from patient bills and multiple billing cycles has not been studied. We hypothesized that uninsured patients bear the greatest financial burden and are at greatest risk for bad debt. Secondary hypotheses included a higher likelihood of bad debt among patients with greater injury severity, higher total charges, or a penetrating mechanism of injury.

Methods: A retrospective review of all trauma patients from 1/11-12/11 was performed at a non-profit, safety net hospital with a level 1 trauma center. Data points included patient demographics, injury related information, and financial information. Patients were stratified by insurance type to evaluate the likelihood of having bad debt. Additional analysis was performed based on the following: ISS ($< \text{or} \geq 15$), mechanism of injury (blunt or penetrating), and total charges ($< \text{or} \geq \$100{,}000$). Hospital revenue from trauma (HRT) was calculated as the sum of patient and insurance payments and disproportionate share hospital (DSH) funding allocated to accounts. Hospital charges (not costs), adjusted bills, and payments were reviewed and analyzed using Chi square and logistic regression.

Results: 3360 patients were analyzed and had an average total charge of $81,256. 17.7% of all patients were sent for bad debt to non-hospital billing services. Type of insurance ($p<0.001$), total charge $< \$100{,}000$ ($p<0.001$), penetrating injury ($p<0.001$), and ISS ≤ 15 ($p=0.01$) were significant independent variables associated with bad debt. After controlling for confounding variables, patients without insurance (OR=12.7, CI=9.7-16.1, $p<0.001$), patients with private insurance (OR=8.0, CI=5.9-10.8, $p<0.001$), and patients with total charges $< \$100{,}000$ (OR=1.6, CI=1.2-2.2, $p=0.004$) were more likely to have bad debt. Although patients with no insurance or private insurance were most likely to have bad debt, the groups differed greatly. Private insurance patients accounted for 59% of HRT despite being only 18% of the trauma population while uninsured patients accounted for 30% of the trauma population and only 7% of HRT.

Conclusion: Uninsured patients and patients with private insurance, especially those with charges $<\$100{,}000$, are at the greatest risk of bad debt. Strategies such as assisting in the application for insurance and proactively negotiating billing should be implemented prior to discharge in the patients identified as high risk for financial burden.

Poster # 93

IMPACT OF THE AFFORDABLE CARE ACT ON TRAUMA CENTER FINANCIALS

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Introduction: Hospital financial pressures and inadequate reimbursement contribute to the closure of trauma centers. Uninsured patients contribute significantly to the burden of trauma center costs. The Affordable Care Act was implemented in April 2014 to provide health care coverage for all Americans. This study analyzes the impact of the recent health care changes on trauma center financials.

Methods: We conducted an analysis of trauma charges at an Ohio Level 1 trauma center. A three-year trauma patient cohort (2012-2014) was selected and grouped by reimbursement source (Medicare, Medicaid, other government, commercial, and self-pay/charity). Data was collected and analyzed with the Transition Systems Inc. accounting system.

Results: Self-pay/charity charges decreased substantially (9.5% to 4% of total charges) Medicaid increased (21.4% to 25.9% of total charges) (see Table 1). Table 2 shows the number of trauma patients and net revenue for 2012-2014.

	2014		2013		2012	
	Charges ($)	%	Charges ($)	%	Charges ($)	%
Commercial	72,553,784	34.5	74,704,875	36	86,891,198	36.7
Medicare	62,872,208	29.9	61,996,197	29.9	62,647,700	26.4
Medicaid	54,314,109	25.9	37,272,540	18.2	50,690,091	21.4
Other Gov.	11,796,195	5.6	12,312,719	5.9	14,300,437	6
Self-Pay/ Charity	8,597,187	4	21,039,155	10.1	22,455,235	9.5
Total	210,106,483	100	207,328,486	100	236,984,661	100

TABLE 1: Trauma center charges by reimbursement type for 2012-2014.

	Number of Patients (N)	Net Revenue ($)	[Net Rev ($)]/N
2014	3,245	58,832,047	18,130
2013	3,276	51,323,791	15,667
2012	3,134	58,101,318	18,539
Total	9,655	168,257,156	17,427

TABLE 2: Total number of patients (N) and net revenue for 2012-2014.

Conclusions: In the first year following the implementation of the Affordable Care Act, self-pay/charity charges have decreased and Medicaid charges have increased. Although more data collection and analysis need to be done, this is an initial step toward evaluating the beneficial effects of the Affordable Care Act on trauma centers.

Poster # 94

LOST TO FOLLOW-UP: FACTORS ASSOCIATED WITH PATIENT DROPOUT IN RESEARCH INVOLVING TRAUMA PATIENTS

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Introduction: Loss to follow-up is common problem in research studies involving vulnerable (socioeconomically and racially marginalized) populations, especially those who have sustained major trauma. High attrition rates can compromise achievement of the study goals, introduce bias and threaten the validity as well as the generalizability of the research findings. A better understanding of factors associated with the high drop-out rates seen in trauma populations are essential to the development of appropriate recruitment and retention strategies.

Methods: We evaluated factors associated with loss to follow-up in a cohort of 158 trauma patients enrolled in a prospective study of traumatic stress biomarkers. The subjects were recruited from the pool of patients seeking care for traumatic injury at a large urban Level 1 Trauma Center. Information on a detailed set of sociodemographic and psychological variables was collected at the time of hospital admission and approximately 1 month post-injury (FU1). Univariate and multivariate analyses were used to determine factors associated with non-completers that missed follow-up appointments.

Results: Most enrolled subjects were young (34.4 years ± 13), single (73.4%), Hispanic (65.2 %), males (76 %) with high school or less education (60.2%). A total of 53 subjects (34%) did not return for the scheduled FU1 visit. In a univariate logistic regression analysis, pain was significantly (OR=3.64, p=0.009) related to the probability of being a non-completer. For the multivariate analysis, using stepwise multiple logistic regression, non-completers were more likely to be African-American (OR=2.83, p=0.09), married or living with a partner (OR=2.54, p=0.05), be age 30 or younger (OR=2.11, p=0.10). Non-completers were also less likely to manifest pain (OR=0.33,p=0.06).

Conclusion: Loss to follow-up is a major problem with research studies involving vulnerable populations with traumatic injury. Individuals lost to follow-up are a clinically and demographically different patient population from those who return for scheduled visits. Intervention strategies include culturally-competent research staff and care coordinators, the use of incentives, and well articulated and intensive patient tracking systems.

Poster # 95

MASSACHUSETTS HEALTH CARE REFORM REDUCES INTER-FACILITY TRANSFER

Wenjun Li Ph.D., Holly Hackman MD, Selwyn Rogers* Jr., MD, Sylvia Hobbs* MPH, Turner Osler* MD, University of Massachusetts

Introduction: Inter-facility transfer affects medical outcomes and costs of trauma care. The goals of the 2006 Massachusetts Health Care Reform include expanding insurance coverage and reducing total care cost. The impact of HCR on inter-facility transfer is unknown.

Methods: We analyzed live discharge dispositions of 429,810 trauma patients of age 18 to 64 years in the State Inpatient Data from Massachusetts (MA) and New York (NY) for the pre-HCR period (2002-2006) and the post-HCR period (2008-2012). NY served as the non-HCR control. Using a difference-in-difference approach, we compared pre-post changes in inter-facility transfer, stratified by race/ethnicity and payer type.

Results: As shown in Table 1, inter-facility transfers occurred more frequent in MA than NY, among privately insured patients, and among patient of white race. Among privately insured patients, inter-facility transfers decreased in MA but increased in NY during the post-HCR period. Among Medicaid recipients, post-HCR reductions were larger in MA than in NY, for all three racial/ethnic groups.

Table 1 Percent of inter-facility transfers (* p<0.05)

		MA			NY			Diff. in Diff.
	Total N	Pre	Post	Diff.	Pre	Post	Diff.	
Privately insured patients, age 18-64 years								
Overall	286,175	16.2	13.8	**-2.4***	11.4	12.4	**1.0***	**-3.4***
White	236,744	16.5	14.1	**-2.4***	11.9	13.0	**1.1***	**-3.6***
Black	29,282	15.5	13.7	-1.9	10.4	10.8	0.4	**-2.3***
Hispanic	20,149	10.4	9.8	-0.5	7.0	8.5	**1.6***	**-2.1***
Medicaid recipients, age 18-64 years								
Overall	143,635	21.6	16.4	**-5.2***	13.1	12.4	**-0.7***	**-4.5***
White	76,789	22.6	17.8	**-4.8***	15.7	14.8	**-1.0***	**-3.9***
Black	39,957	20.8	13.3	**-7.6***	11.8	10.8	**-1.0***	**-6.6***
Hispanic	26,889	16.6	13.2	**-3.4***	8.3	8.5	0.2	**-3.6***

Conclusions: MA HCR reduced the extent as well as racial disparities in inter-facility transfers. However, Hispanic-white disparities persisted after HCR. Future studies should investigate the underlying mechanisms and impact on medical outcomes to improve transfer policy and practice.

Poster # 96

MASSACHUSETTS HEALTH CARE REFORM INCREASES DISCHARGES TO HOME HEALTH CARE

Wenjun Li Ph.D., Turner Osler* MD, Holly Hackman MD, Hyung-joo Kang MS, Sylvia Hobbs MPH, Selwyn O. Rogers* Jr., MD, University of Massachusetts

Introduction: Post-hospitalization care is important to restore function and improve quality of life among trauma patients. The goals of the 2006 Massachusetts Health Care Reform (HCR) include expanding insurance coverage and reducing health care cost. The impact of HCR upon disposition of trauma patients is unknown.

Methods: We analyzed live discharge dispositions of 429,810 trauma patients of age 18 to 64 years in the State Inpatient Data from Massachusetts (MA) and New York (NY) for the pre-HCR period (2002-2006) and the post-HCR period (2008-2012). NY served as the non-HCR control. A difference-in-difference approach compared pre-post changes in discharges to home health care, stratified by race and payer type.

Results: Discharges to home health care were nearly twice more frequent in MA than NY, and less likely among black and Hispanic patients with a private insurance. Among privately insured patients, post-HCR increases in discharge to home health care were significantly larger in MA than NY.

Table 1 Percent of discharges to home health care (* $p<0.05$)

	MA			NY			Diff. in Diff.
	Pre	Post	Diff.	Pre	Post	Diff.	
Privately insured patients, age 18-64 years							
Overall	15.8	19.2	**3.4***	8.9	11.1	**2.2***	**1.2***
White	16.1	19.4	**3.4***	9.4	11.6	**2.3***	**1.1***
Black	13.9	16.7	**2.8***	6.8	9.3	**2.5***	0.3
Hispanic	13.0	17.3	**4.3***	7.1	8.9	**1.8***	**2.5***
Medicaid recipients, age 18-64 years							
Overall	13.0	14.1	**1.1***	5.5	7.5	**2.1***	**-1.0***
White	13.4	14.3	0.9	6.2	8.1	**1.9***	**-1.0***
Black	10.1	12.0	1.9	4.6	6.5	**1.8***	0.1
Hispanic	14.0	14.9	1.0	4.9	7.7	**2.8***	-1.8

Conclusions: MA HCR increased the discharges to home health care among privately insured patients of age 18-64 years, but not Medicaid recipients. Reasons for and consequences of the increases should be investigated.

Poster # 97

ECONOMIC ASSESSMENT OF ORTHOPEDIC TRAUMA PROCEDURES AT A LEVEL I TRAUMA CENTER AND FINANCIAL FEASIBILITY OF FUNDING A DEDICATED ORTHOPEDIC TRAUMATOLOGY PRACTICE

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Background: Orthopedic injuries are the most frequently encountered injuries requiring operative management on inpatient trauma services. Private orthopedic surgeons perform most orthopedic traumatology services, however fewer are practicing traumatology, often citing poor payer mix and reimbursement concerns as deterrents although little published data are available to support this. The purpose of this study is to assess the financial impact of orthopedic trauma at a Level I trauma center and to determine if an integrated orthopedic traumatology service within the department of acute care surgery could be financially sustainable.

Methods: This is a retrospective analysis of inpatient, non-spine orthopedic trauma surgical procedures performed over 2 years at a Level I trauma center that contracts trauma orthopedic services with private orthopedic surgeons. The NTRACS database was queried for patient demographics, payer sources and orthopedic procedures. The total physician fee reimbursement and hospital-supported call pay were used to determine the annual financial support to fund orthopedic traumatology. The Medical Group Management Association (MGMA) annual report and institutional human resources data were used to determine orthopedic surgeon and advanced level practitioner (ALP) salaries and annual expenses.

Results: A total of 3083 trauma orthopedic surgical procedures were performed on 1448 patients over 2 years. Reimbursement was provided by 10 unique payers; Medicare, private insurers and self-pay patients were the primary payers for 33% (n=471), 23.4% (n=338) and 18.9% (n=274) of patients and 22.5% (n=693), 25% (n=777) and 23% (n=711) of the procedures, respectively. Medicare patients had the fewest procedures per patient performed at 1.5 procedures, however they had the highest average reimbursement per procedure out of all payers at $815. The total physician fee reimbursement for the 2-year study period was approximately $2,055,600. Annual hospital-supported call pay is $547,500, bringing the total potential annual funding for orthopedic traumatology to $1,575,300. Expenses required to annually fund an academic vs. private orthopedic surgeon at the national average is $668,700 and $786,400, respectively, and $124,600 to fund an ALP. In order to provide adequate coverage for 1500-1600 orthopedic trauma surgical procedures per year, we predict the need for 3 orthopedic surgeons and 1 ALP at an expense of $2,130,700 annually for academic surgeons salaried at the national average, leaving a funding deficit of $555,400. A smaller annual deficit of $64,700 would exist if reimbursing academic surgeons at the 25 th percentile.

Conclusions: This financial analysis of orthopedic trauma reveals that physician fees and hospital supported call pay are inadequate to fund a dedicated, academic or private orthopedic trauma service at this institution and likely others with a similar payer mix and practice profile. Feasibility for funding improves with a more favorable patient payer mix such as Medicare and private insurers. Growing evidence that dedicated orthopedic traumatology may reduce complications, improve clinical outcomes and reduce hospital days may financially incentivize hospitals to support orthopedic traumatology.

Poster # 98

TRAINING THE FORWARD DEPLOYED SURGEON: IS ACS FELLOWSHIP THE ANSWER?

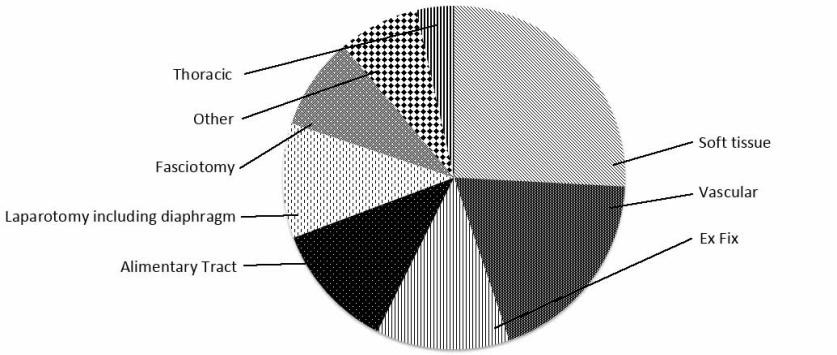
William H. Scott DO, Nichole K. Ingalls MD,MPH, Paul J. Chestovich MD, Timothy D. Browder* MD, Vilas Saldanha MD, John J. Fildes* MD, University of Nevada School of Medicine

Introduction: Frontline wartime surgeons need varied skills. Multiple authors have shown that injured combatants receive comparable care at forward surgical units compared to combat support hospitals where more surgical specialists are available. Military doctrine dictates that forward surgical units are staffed with general surgeons and an orthopedic surgeon. The skill set of the general surgeon must encompass a broad spectrum of surgical specialties that the typical military surgeon might not possess. We investigated whether training in an acute care surgery (ACS) fellowship provides the case experience needed to prepare forward deployed surgeons.

Methods: After obtaining IRB approval, the Joint Trauma Theater Registry was queried for procedures performed at forward surgical units from 2002-2012. These procedures were then organized by type and compared to the revised 2014 ACS fellowship case requirements.

Results: Over this ten-year period, 34,411 procedures were performed on 9,362 patients. Mean age of patients was 25.9 years. 80.6% of injuries were battle related; 59.2% were penetrating and 38.1% were blunt. Median ISS of these patients was 10 (IQR 5-17). The 34,411 procedures were grouped into categories by the authors. The 6,972 non-operative but critical procedures included: 2,279 FAST exams, 1,735 splint/casting, and 1,040 tube thoracostomies. The operative procedures (n=8,887) were grouped into categories and 99.7% of these procedures are part of the ACS fellowship curriculum (Figure 1). There were only 27 operative cases not included in the fellowship curriculum and that included 3 gynecologic operations and 24 burns/grafting. There were also 2,157 cases that are primarily orthopedic including 758 amputations and 501 definitive internal fixation. The external fixation, fasciotomies, and other basic orthopedic procedures included in the ACS curriculum are reflected in the 99.7% concurrence of deployed operations and curriculum. In addition, 1,918 ICU patients were managed which is a standard part of the ACS fellowship curriculum.

Figure 1. Operative procedures performed at forward surgical units. [Other includes: urologic, neck procedures, hepatobiliary including pancreas, eye procedures, neurosurgical, and spleen.]



Conclusion: The ACS fellowship is a viable model for training forward deployed military surgeons. Surgeons should be encouraged to pursue a fellowship in acute care surgery or participate in a military currency training program that mirrors the ACS fellowship curriculum.

Poster # 99

SENSITIVITY AND SPECIFICITY AT DETECTING FREE INTRA-ABDOMINAL FLUID BY MEDICAL STUDENTS AFTER AN ABBREVIATED FOCUSSED ASSESSMENT WITH SONOGRAPHY (FAST) COURSE. A NOVEL STUDY USING DIAGNOSTIC PERITONEAL LAVAGE (DPL) TO QUANTIFY AND EVALUATE THE PERFORMANCE OF THE NOVICE ULTRASONOGRAPHER.

Matt J. Kaminsky MD, Elizabeth Gwinn MD, Kim Joseph* MD, Dorion Wiley MD, Andy Dennis DO, Starr Fred MD, Faran Bokhari* MD, Kim Nagy* MD, Cook County Hospital

I**ntroduction:** Non-radiologist certification in focussed assessment with sonography in trauma (FAST) and point of care ultrasound has evolved overtime. In general, there has been a trend to fewer minimum certification cases and for formal ultrasound courses being increasingly available to more junior house staff and medical students. Many studies have documented good knowledge acquisition and retention before and after ultrasound courses, however, the performance curve of the novice ultrasonographer in practice can further be explored. We hypothesize that medical students, with directed ultrasound training, would be able to generate proper images of the hepato-renal and spleno-renal fossa components of FAST, as well as the ability to detect a well defined and clinically relevant volume of free intra-abdominal fluid.

Methods: A prospective blinded study was performed at a high volume urban trauma center investigating the performance of 3rd and 4th year medical students with an abbreviated 1 hour video and 1 hour hands on ultrasound course. Novel to this study is the use of patients requiring a diagnostic peritoneal lavage (DPL), for the work up of traumatic injuries, in order to **quantify** the intra-abdominal volume of fluid. At the time of the DPL procedure, students were assessed for image acquisition of the hepato-renal and spleno-renal, as well as the ability to detect 0, 200, 400, 600, 800 and 1000cc of DPL fluid. Image interpretation was evaluated by an individual certified in FAST to establish the sensitivity and specificity of novice performed FAST.

Results: Between June 2013 and August 2014 over 90 medical students rotating in the trauma department underwent the directed training course. 20 patients requiring DPL were paired with a medical student for assessment of ultrasound skill acquisition. Students evaluated were able to generate an adequate image of the hepato-renal fossa at a rate of 90% with performance rate dropping to 67% for the spleno-renal fossa. The mean volume of DPL fluid to correctly generate an initial positive interpretation by the medical student was 625cc (SD 205cc) for the hepato-renal fossa and a mean volume of 833cc (SD 197cc) for the spleno-renal fossa. A sensitivity of 86.5% (CI 74.2% to 94.4%) and specificity of 93.1% (CI 83.3% to 98.1%) was determined for the hepato-renal fossa. For the spleno-renal fossa the students achieved a sensitivity of 61.1% (CI 35.8% to 82.6%) and specificity of 91.9% (CI 82.2% to 97.3%).

Conclusion: After a limited but directed FAST ultrasound training course, students were able to generate adequate images of the hepato-renal and spleno-renal fossa, with good sensitivity and specificity at detecting free fluid, particularly for the hepato-renal fossa. Short directed training courses in ultrasound are feasible, practical and well received by students with clinically relevant performance achievable. Selective training of the hepato-renal view of FAST should further be investigated for practitioners in forward triage scenarios.

Poster # 100

A NOVEL EDUCATIONAL PROGRAM ON END OF LIFE CONVERSATIONS IMPROVES RESIDENT PREPAREDNESS

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Introduction: Standardized education programs on conducting end of life conversations with patient's families in a competent and compassionate manner are lacking in surgical residency programs. The goal of this study was to determine the efficacy of a surgical resident educational program focused on communication of brain death and organ donation.

Methods: A total of 228 surgical residents at 5 academic medical centers completed a didactic program followed by a simulation on communicating brain death. The main outcomes were resident level of comfort and knowledge after this education program.

Results: While 85.5% of residents had been introduced to the concept of brain death during medical school, only 28% had received training in discussing brain death. Of these, 48.6% felt uncomfortable when discussing end of life issues with families. After the educational program, residents better understood when to initiate the conversation regarding organ donation (49.6% vs. 98.6%; $p<0.001$). The educational program improved comfort level (30.7% vs. 83.4%; $p<0.001$) and confidence (34.7% vs. 88.2%; $p<0.001$) in communicating brain death to families. The trauma ICU rates of timely notification to the Organ Procurement Organization improved (82.3% vs. 72.7%; $p = 0.003$) when compared to other units that did not receive training. Organ donation rates in trauma ICUs also improved compared to non-trauma ICUs (54.2% vs. 47.0%; $p = 0.049$) that did not receive training.

Training Program's Effect on Resident Knowledge and Confidence about Brain Death and Organ Transplantation

Question	Correct Response	Pre-training (%)	Post-training (%)	p value
Is brain death synonymous with death?	Yes	49.6	98.6	<0.001
The discussion about organ donation should ideally take place after brain death pronouncement and after a family understands brain death as death.	Agree + Strongly Agree	55.3	97.6	<0.001
In general, families understand brain death.	Disagree + Strongly Disagree	59.7	78.7	<0.001
It is, or should be, a standard protocol to make a referral to Gift of Life of a neurologically injured patient before brain death testing.	Agree + Strongly Agree	57.5	92.4	<0.001
I am confident in my ability to speak with families about brain death.	Agree + Strongly Agree	2.94	4.06	<0.001
I feel comfortable in discussing brain death with families.	Agree + Strongly Agree	2.83	3.94	<0.001

Conclusion: This educational program improved resident knowledge, comfort and confidence while discussing brain death. A standardized educational program makes residents better equipped to have end of life conversations with families of potential organ donors and could increase organ donation rates.

Poster # 101

IS ALCOHOL SCREENING ENOUGH?

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Background: The prevalence of alcohol abuse in the trauma population, its impact on injury, and trauma readmissions has been well documented. Similarly, the role for alcohol screening with SBIRT programs (screening, brief intervention, and referral to treatment) has been entrenched. The literature regarding toxicology screening is less well established. There is little to no literature concerning the impact of and screening for synthetic substances that are not included in standard screening profiles. We sought to investigate rates of screening, alcohol, and substance abuse in our trauma population, to include synthetic substance abuse where possible.

Methods: A retrospective analysis was performed using our trauma registry after institutional review board approval. We looked at the incidence of alcohol and drug intoxication in trauma patients who were admitted after MVC or MCC from January 1, 2014 – December 31, 2014. For selected patients where the clinical index of suspicion was high for synthetic substance abuse, clinical screening was performed, and in some cases, laboratory screening. We eliminated all positive toxicology screens receiving narcotics in the field or emergency room. All screening of individual patients were performed at the discretion of the attending physician.

Results: We admitted 697 patients after motor vehicle collision (MVC) or motorcycle collision (MCC). The average age of these patients was 34.7 with a mean ISS of 7.4. Alcohol testing was done in 495 patients, and 182 patients tested positive (36.8%). Toxicology screening was performed in 405 patients, and 212 of these patients tested positive (52.3%). We identified 15 patients whose clinical behavior was highly suggestive of substance abuse but whose alcohol and toxicology screenings were negative. All 15 of these patients admitted to synthetic drug use, in particular synthetic cannabinoid receptor agonists. In 4 of these 15 patients, laboratory analysis for synthetic cannabinoid receptor agonists was performed. All 4 samples were positive.

Conclusions: At our institution, the proportion of patients with positive toxicology screens was higher than the proportion screening positive for alcohol. This stands in contrast to the relative focus given to alcohol screening and intervention nationally. Not only are patients increasingly using illicit substances, but there is a trend towards abuse of synthetic substances which are not screened for. Toxicology screening with substance abuse intervention should be emphasized as this issue may affect an increasing portion of the trauma population. The inclusion of screening for synthetic substances is a topic that warrants additional research.

Poster # 102

THINKING OUTSIDE THE BOX: REEVALUATING THE NEED FOR CARDIOPULMONARY BYPASS IN PENETRATING CARDIAC INJURIES

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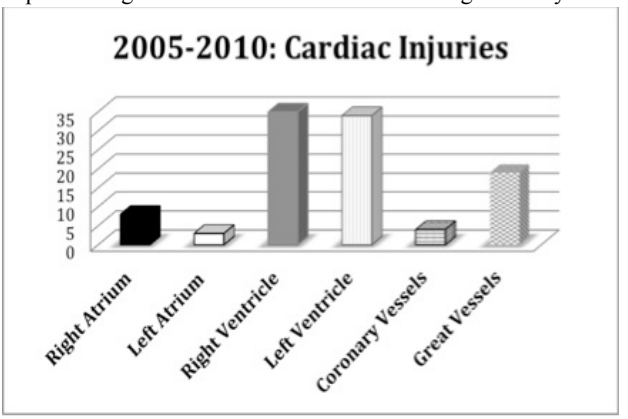
Introduction: The availability of cardiopulmonary bypass and cardiothoracic surgery is required by the American College of Surgeons Committee on Trauma (ACS-COT) for Level I verification, as well as by states that have their own trauma center designation criteria. Maintenance of cardiac bypass capability, including the personnel and equipment, is labor intensive and expensive. The purpose of this study was to review a trauma surgeon-driven experience with penetrating cardiac trauma at a Level 1 trauma center with a high percentage of penetrating injury. The goal was to determine if it is feasible to care for patients with cardiac injuries without cardiac bypass.

Methods: **:** All patients requiring sternotomy or thoracotomy following penetrating thoracic trauma were identified from 2005-2010. Demographic and injury related data were obtained. The types and location of cardiac injury, as well as patient outcomes, were determined from operative reports.

Results: 1,701 patients with penetrating chest trauma were admitted during the study period. 260 patients met criteria for the review. 37 had an emergency department thoracotomy, with a survival rate of 8%. Overall, 76 patients (29%) suffered a cardiac injury. 69 patients underwent sternotomy, in which 50 cardiac injuries were identified. 71% of these patients had a preoperative FAST exam, which had a positive predictive value of 56.5%. 78% underwent a pericardial window, which had a positive predictive value of 81.4%. The types of cardiac injury are shown in the table. 38% (n=29) of the patients with a cardiac injury died while the overall death rate in this cohort was 21%. No patients in the cohort required cardiopulmonary bypass for emergent repair of cardiac injury and trauma surgeons, without cardiothoracic consultation, performed all cases.



Conclusion: Cardiac injuries are not uncommon in patients with penetrating injury to the thorax. These injuries are clearly survivable if access to operative repair is rapid. In this cohort, FAST was equivocal while pericardial window was fairly sensitive. Injuries to the ventricles were most common overall. Despite the high acuity of the injuries, none required immediate cardiothoracic consultation or cardiopulmonary bypass for repair. Based on this review, cardiopulmonary bypass is rarely necessary. The ACS-COT Level 1 trauma center requirement for bypass capability is outdated and should be abandoned.

Poster # 103

IMPLEMENTATION OF A MULTIDISCIPLINARY RIB FRACTURE MANAGEMENT PROTOCOL INCLUDING SELECTIVE OPEN REDUCTION AND INTERNAL FIXATION: SAFETY AND IMPACT ON INPATIENT OUTCOMES.

Martin Rosenthal MD, Scott Brakenridge MD, Chasen Croft* MD, Jianyi Zhang Ph.D., Janeen Jordan MD, Alicia Mohr* MD, Andre Boezaart MD, Frederick Moore* MD, Lawrence Lottenberg* MD, University Of Floirda

Introduction: Rib fractures remain a significant cause of morbidity and mortality after blunt thoracic trauma. In this large, single center series, we evaluated the implementation of a multi-disciplinary rib fracture management protocol and the effect of selective open reduction and internal fixation (ORIF) on inpatient outcomes.

Methods: Our Level I trauma center implemented a multi-disciplinary traumatic rib fracture management protocol, consisting of acute pain management with adjunctive neuraxial analgesia, pulmonary therapy, ventilator support as needed, and selective ORIF. Indications for ORIF include anatomic disruption, flail chest and refractory pain limiting productive cough and inspiratory capacity. A retrospective, propensity matched and adjusted analysis was performed to compare ORIF and non-operative inpatient outcomes under this management protocol.

Results: Between January 2007 and May 2014, our center managed 5,262 trauma patients with ≥2 rib fractures. Of these patients, 81 (1.5%) underwent ORIF. ORIF patients were more severely injured (ISS 28 vs 20, $p<0.001$) and older (mean 51 vs 46 yrs, $p<0.003$) than the non-operative cohort. The ORIF cohort had median numbers of 7 ribs fractured and 4 ribs fixated. Wound complication rate for patients undergoing ORIF was 2.4%. Ventilator days (6.3 vs 3.1 days), ICU (8.8 vs 3.6 days) and hospital LOS (14.8 vs 7.9 days) were significantly longer in the ORIF cohort ($p<0.001$). Unadjusted mortality was lower in the fixation group than the non-operative cohort (1.2% vs. 8.6%, $p<0.02$). However, both propensity matched and adjusted modeling to account for injury severity, age, gender, comorbidities, number of rib fractures, and flail segment revealed no significant differences in these outcomes between ORIF and non-operative management. Among ORIF cases, the high propensity cohort (median 0.88, IQR 0.83-0.96) included patients with higher number of rib fractures (median 8 vs. 6, $p<0.004$), and flail segment (58 vs 21%, $p<0.001$) than the lower propensity cohort (median 0.44, IQR 0.29-0.59), and had no difference in inpatient outcomes.

Conclusion: Operative rib fixation as part of a multidisciplinary management protocol, while safe, demonstrates no differences in inpatient outcomes, including pneumonia, ventilator days, ICU and hospital length of stay, and mortality. Surgeon indication bias appears based primarily on number of rib fractures and anatomic disruption. Future prospective investigations should utilize algorithm-based management, attempt to discern which patient sub-populations may benefit most from ORIF, and focus on outpatient functional outcomes including assessments of pain, physical function, quality of life, and return to work.

Poster # 104

MORE THAN MEETS THE EYE: BLUNT DIAPHRAGMATIC INJURIES POORLY IDENTIFIED WITH COMPUTED TOMOGRAPHY

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Introduction: Each year, 2.3 million people are admitted to the hospital across the country as a result of trauma. For many of these patients, we rely on imaging to help diagnose and confirm suspected injuries. Computed tomography (CT) is a major adjunct in the workup of these patients. In our experience, traumatic diaphragmatic injury (TDI) in the setting of blunt trauma is an area with which CT scanners continue to prove inadequate despite improvements in resolution. Missing such an injury can have long-term implications including delayed presentation, incarceration, strangulation, and need for emergent repair. This study aimed to determine the sensitivity and accuracy of CT for evaluation of traumatic diaphragmatic injury (TDI) in blunt trauma patients at our institution, and we hypothesized that both would be poor.

Methods: We performed an IRB approved retrospective review of all adult blunt trauma patients admitted to our Level 1 trauma center between 2003 and 2013. Patient variables were collected from the trauma registry. Inclusion criteria included those blunt trauma patients who had pre-operative CT findings suggesting chest trauma (pulmonary contusion, pneumothorax/hemothorax, or rib fractures), *and* intra-abdominal solid organ injury; *and* underwent an exploratory laparotomy. The study group consisted of those patients with a diaphragm injury confirmed via exploratory laparotomy. The control group had no operative evidence of diaphragm injury. Four blinded, board certified radiologists reviewed all 82 CT studies knowing only a history of blunt trauma. Primary outcome was identification of diaphragm injury on pre-operative CT imaging.

Results: A total of 82 patients met the inclusion criteria, equally divided into study and control groups of 41 patients each. Average injury severity scores were comparatively equal (33 ± 11 vs 34 ± 14, $p=0.79$). Overall sensitivity was 57% (95%CI: 49.1-64.1) and specificity was 91% (95%CI: 85.4-94.5). For the individual radiologists, sensitivities ranged from 32% to 81% with corresponding specificities ranging from 98% to 78%. Only 12 (30%) of the studies from patients with established diaphragmatic injury were read as positive by all four radiologists; four (10%) were read as negative by all four radiologists. The overall accuracy of diagnostic CT for TDI was 71%. Overall false positive and false negative rates were 11% and 44%, respectively.

Conclusion: This study demonstrates that, despite a high specificity, CT imaging remains inadequate for diagnosis of blunt diaphragmatic injury as evidenced by poor sensitivity and wide variability amongst reviewing radiologists.

Poster # 105

MAGNITUDE OF RIB FRACTURE DISPLACEMENT PREDICTS OPIOID REQUIREMENT.

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Introduction:The presence and number of rib fractures (RF) in patients with blunt thoracic trauma correlate with clinical outcomes including pain medication requirement, days on mechanical ventilation (DMV), intensive care unit and hospital length of stay (iLOS and hLOS, respectively), discharge disposition and mortality. However, the effect of the magnitude of RF displacement on these outcomes is still obscure.
Methods:A retrospective review of adult patients with acute blunt RF and available chest computed tomography (CT) treated at an urban Level I trauma center between 2007-2012. Characteristics and outcomes of patients with at least one displaced RF (DRF) were compared to those with no DRF (NDRF) using univariate analysis. Regression analysis was utilized to 1) examine associations between maximal DRF displacement (determined in 3D using axial, sagittal and coronal CT sections) and outcome parameters, and 2) determine whether the total magnitude of RF displacement (sum of the magnitude of all displaced RF in each patient) predicts total (sum of all doses given) opioids requirement (expressed in morphine equianalgesic doses), use of epidural and patient controlled (PCA) analgesia, iLOS, hLOS, DMV, and disposition.
Results:There were 245 patients with 1127 RF. When compared to NDRF patients (n=77, 621 NDRF), DRF patients (n=168, 506 DRF) were older (61.0 vs. 54 years, p=0.008), had a higher Injury Severity Score (17.4 vs. 14.4, p=0.03), a longer hLOS (median 5 vs. 3 days, p=0.032), exclusively used epidural analgesia (9%), required more opioids (median dose 135.8 mg vs. 66.7 mg, p=0.0175) and PCA (27.1% vs. 10.4%, p=0.0033), and were more often discharged to rehab (60.3% vs.45.3%, p=0.03). Admission to ICU, DMV, iLOS and mortality did not differ between two groups. Lastly, the magnitude of RF displacement (expressed as the sum of all displaced RF in each patient) was associated with (R square 0.124) and predicted the total opioids dose ($p<0.0001$), but not hLOS or disposition to rehab. Prediction of epidural and PCA analgesia could not have been determined due to the small number of patients in these groups.

Conclusion: DRF patients had worse outcomes than NDRF patients and the magnitude of RF displacement predicted opioids requirements. This information may assist in managing advanced pain control. Given the association of DRF with opioids requirements, hLOS and discharge to rehab, DRF may be considered as an indication for surgical rib fracture fixation, but further studies are needed to support this notion.

Poster # 106

DELETERIOUS IMPACT OF INCREASING BODY MASS INDEX ON PATIENTS WITH BLUNT CHEST WALL INJURY

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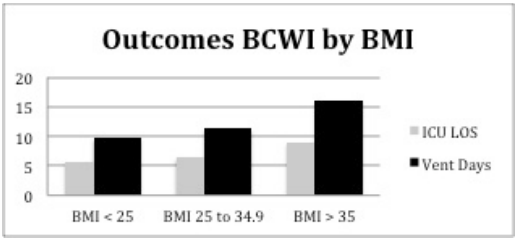
Introduction: The Centers for Disease Control estimates that 69% of the US adult population is overweight defined by a body mass index (BMI) $\geq$ 25. Many of these individuals have significant medical comorbidity, including pulmonary disease. The potential impact of excess body weight upon patients with chest trauma has not been thoroughly evaluated. Blunt chest wall injury (BCWI) manifest as rib fractures is present in 10% of all trauma patients and is associated with substantial pulmonary morbidity and mortality. We hypothesized that excess body weight would manifest a deleterious influence on clinical outcomes of patients with BCWI.

Methods: We performed a retrospective analysis of all adult trauma patients admitted to a level I trauma center with BCWI from 1/1/2006 to 01/01/2013. Collected data included patient demographics, mechanism of injury, radiographic data, clinical outcomes, ICU length of stay (ICU LOS) and mortality. Patients with penetrating injury to the chest and those who expired in the emergency department prior to thoracic diagnostic imaging were excluded.

Results: The analysis identified 818 patients with BCWI. The mortality rate of the composite study population was 4.4% (36/818). The study population was 72.5% male and injured by blunt mechanism: motor vehicle crash 48%, motorcycle crash 17%, fall 17.5%, motor pedestrian 9.5%, and other 7.8%. Of the BCWI patients, 28.2% (n=231) had 1-3 rib fractures, 30.8% (n=-252) had 4-6 rib fractures, 21.1% (n=173) had 7-9 rib fractures, 19.9% (n=162) had $\geq$ 10 rib fractures. For the BMI analysis, 30.6% (n=25) were BMI<25, 55.6% (n=455) were BMI 25 to 34.9, and 13.8% (113) were BMI $\geq$ 35.



BMI $\geq$35 was associated with increased mortality in patients with 7 or more rib fractures (18%) compared to 4% mortality in patients with fewer rib fractures (p = 0.008). Kaplan Meier analysis demonstrated BMI $\geq$ 35 to be associated with a prolongation of ICU LOS in patients with moderate to severe BCWI which was most apparent in patients with $\geq$ 4 rib fractures with a mean ICU LOS of 10 days compared 5 days for patients with $\leq$ 3 rib fractures.

Conclusion: Deleterious outcomes in patients with BCWI are exacerbated with increasing BMI, especially those $\geq$ 35 making care of these patients care more prolonged and complicated. Further definition and prospective validation may enhance the development of evidence based clinical pathways to optimize the management of this population.

Poster # 107

BLUNT CHEST WALL TRAUMA: MANAGEMENT OF HEMOTHORAX

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Introduction: Blunt chest wall trauma causes significant morbidity and mortality amongst trauma patients. With the CT era in trauma care, more patients are undergoing diagnosis of small hemothoraces. Hemothorax can be associated with respiratory failure, fibrothorax, empyema and prolonged hospitalization. Recently, several small studies have concluded that occult hemothorax can be managed without chest tube if less than 1.5 cm in axial dimension on CT scan. The purpose of this study was to evaluate outcomes in management of blunt chest wall trauma with hemothorax.

Methods: This was a retrospective cohort study over a 5 year period of all patients admitted with blunt chest wall trauma to a level one trauma center. All patients with hemothorax found on chest CT were included. Previously described methods of measuring hemothorax using the greatest lamellar fluid stripe in the dependant pleural gutter on transverse axial cuts were utilized. Patients that required chest tube placement after 24 hours of admission (delayed) were compared to patients that were managed with observation alone in regards to size of hemothorax and outcomes. Lastly, outcomes of patients with delayed and immediate chest tubes were evaluated.

Results: During a 5 year period, 2,324 patients were admitted with blunt chest wall trauma. Of which, 271 patients had evidence of hemothorax on chest CT. Eight-nine patients had a chest tube placed within 24 hours of admission, 29 patients had a chest tube placed after 24 hours of admission, and 153 patients had no chest tube placed during their hospitalization. The delayed group average age was 56.4 years versus 61.6 in the no chest tube group. Twenty (69%) patients in the delayed chest tube group had associated pneumothorax compared to 74 (48.4%) patients within the no chest tube group. Patients who did not have an immediate chest tube placed on admission had an odds ratio of 6.78 of requiring delayed chest tube if hemothorax was > 1.5 cm in axial cuts on chest CT. On comparison of delayed versus immediate chest tube groups, the groups were similar in respects to age, associated pneumothorax, ISS and comorbidities. Patients in the delayed chest tube group had increased length of stay compared to the immediate group, 14 versus 11 days respectively ($p = 0.014$). Other outcomes including ventilator days, pneumonia and mortality were similar between the two chest tube groups.

Conclusion: A greater number of small hemothoraces are diagnosed with increased use of chest CT. Currently there are no formal guidelines on management strategy of small hemothoraces. Patients with hemothorax > 1.5 cm in axial dimensions on CT were 6 times more likely to require a chest tube during their hospitalization. Delayed chest tube placement prolonged hospitalization by 3 days in similar matched groups. Measurement of hemothorax on axial CT cuts is easy, reproducible and can provide guidance on which hemothoraces require drainage.

Poster # 108

DOWN BUT NOT OUT: RIB FRACTURES IN THE SUPER-ELDERLY

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Introduction: Elderly trauma patients (age ≥65) with rib fractures have increased morbidity and mortality as compared to their younger counterparts. However, there is a paucity of research dedicated to outcomes in the super-elderly (age ≥80) trauma patient. We sought to clearly characterize the outcomes of the super-elderly as a distinct portion of our overall elderly rib fracture population.

Methods: A retrospective review of 542 elderly trauma patients with rib fractures at a Level 1 trauma center between January 2011 and June 2014 was performed. These patients were further subdivided into two cohorts based on age. There were 275 patients in the elderly group (age 65-79 years) and 267 patients in the super-elderly group (age ≥80 years). Outcomes included intensive care unit and hospital lengths of stay (ICU LOS and HLOS, respectively), ventilator days, pulmonary complications, disposition, and mortality.

Results: The two groups had similar mean number of rib fractures (4.5 elderly vs. 4.4 super-elderly; p=0.72), mean thorax Abbreviated Injury Score (2.6 vs. 2.5; p=0.15), and ICU utilization (61.1% vs. 61.4%; p=1.0). The elderly group had less falls (45.6% vs. 70.2%; p<0.0001) and a higher Injury Severity Score (15.8 vs. 14.3; p<0.04) as compared to the super-elderly. Although mean ventilator days were similar (7.3 vs. 5.8 days; p=0.22) for both groups, the elderly population was more likely to be intubated (28% vs. 20%; p<0.046), and have acute respiratory failure (22% vs. 12.7%; p< 0.005). Mean ICU LOS (6.7 vs. 5.2 days; p<0.03) and HLOS (9.1 vs. 7.6 days; p<0.01) were increased for the elderly. Both populations had similar occurrence of pneumonia (6.2% vs. 4.5%; p=0.45), pulmonary embolism (2.9% vs. 2.6%; p=1.0) and in-hospital mortality was equivalent (11.6% vs. 13.5%; p= 0.5). Notably, by 48 hours over 50% of mortality in the super-elderly group had occurred; whereas the elderly group did not reach this threshold until 7 days. The elderly population was more likely to be discharged home (41.1% vs. 26.1%; p < 0.02) and less likely to be discharged to a skilled nursing facility (27.6% vs. 37.2%; p<0.02).

Conclusion: Rib fractures in the geriatric trauma population remain a significant source of morbidity and mortality. Compared to the elderly cohort, the super-elderly with equivalent number of rib fractures show similar morbidity and mortality while utilizing fewer hospital resources, potentially secondary to earlier mortality or variances in goals of care. Based on our findings, further research into the pre-injury physiologic status and potential variances in treatment patterns of the super-elderly are warranted in attempts to understand injury and optimize outcomes in this expanding population.

Poster # 109

TRAUMATIC PULMONARY PSEUDOCYSTS AFTER BLUNT CHEST TRAUMA: PREVALENCE, MECHANISMS OF INJURY, AND COMPUTED TOMOGRAPHY FINDINGS

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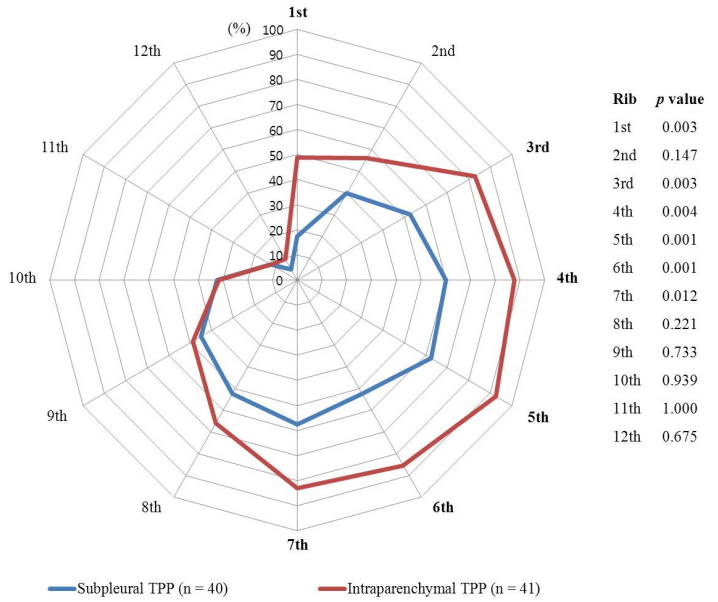
Introduction: Traumatic pulmonary pseudocyst (TPP) is a rare complication of blunt chest trauma and closely related with severe injury. However, it has been poorly documented. The authors present a retrospective review of TPP cases treated at their hospital.

Methods: The medical records and chest computed tomography scans of patients with traumatic pulmonary pseudocyst treated from January 2010 to December 2013 were retrospectively studied.

Results: 978 patients underwent chest CT for blunt chest trauma during the study period, and 81 (8.3%) had a total of 150 TPPs. The most common mechanism of injury was being struck by a motorized vehicle (n = 25, 30.9%). Mean injury severity score of the 81 patients was 33.2 ± 11.4. The prevalence of TPP was higher in younger patients (p = 0.011) but the total number of fractured ribs was significantly lower (p = 0.001). In subgroup analysis performed according to pseudocyst location, the intraparenchymal group had more severe injuries than the subpleural group (injury severity score: 23.3 vs. 32.4, p < 0.001; chest abbreviated injury score: 3.4 vs. 4.0, p < 0.001; number of associated injuries: 2.9 vs. 4.0, p = 0.001). By multivariate analysis, injury severity score, age, and number of associated injuries were significantly different in these two groups (p = 0.038, p = 0.006, and p = 0.045, respectively).

Rate of fracture by rib number in subpleural and intraparenchymal TPP group



Rib	*p* value
1st	0.003
2nd	0.147
3rd	0.003
4th	0.004
5th	0.001
6th	0.001
7th	0.012
8th	0.221
9th	0.733
10th	0.939
11th	1.000
12th	0.675

Conclusion: The prevalence of TPP among cases of blunt chest trauma was 8.3% and was higher in those struck by a vehicle and younger patients. Intraparenchymal pseudocyst was found to be related to more severe injuries.

Poster # 110

NATIONAL TRAUMA DATABASE MANAGEMENT OF RIB FRACTURES: WHICH IS BETTER, PARAVERTEBRAL OR EPIDURAL CATHETERS

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Introduction: Several studies have shown superior outcomes of epidural analgesia in patients with severe chest wall trauma. In other studies, the number of rib fractures correlated with mortality. Often, trauma patients are not candidates for epidural analgesia secondary to other injuries including thoracic vertebral fractures, spinal cord injuries, severe head injury, unstable pelvis, and coagulopathy. Paravertebral blocks do not have the same contraindications as epidural catheters but it is unclear if these blocks provide similar analgesia and outcomes.

Methods: This was a retrospective review of the National Trauma Database over a two year period, 2011-2012. All patients admitted with rib fractures were reviewed. Overall outcomes of patient's who received paraveterbal blocks were compared to epidural analgesia. Propensity score matching was then performed and outcomes were compared between the two groups. Lastly, propensity score matching was performed for patients in either treatment group compared to patients who received neither treatment and outcomes were compared.

Results: During the two year study period, the epidural analgesia group included 1,073 patients, the paravertebral block group included 1,110 patients and 192, 583 patients with rib fractures had neither procedure. Overall, patients who received paravertebral blocks were younger (54.5 vs 58 years) and had lower ISS (14 vs 17) compared to the epidural group. The two groups had similar Glasgow Coma Scores and mean abbreviated chest injury score of 3. The epidural group were more likely to have pulmonary contusions (38% vs 34%), pneumothorax (53% vs 48%) and hemothorax (28% vs 21%) compared to the paravertebral block group. Overall outcomes found no difference in length of stay (LOS), ventilator days, pneumonia, or mortality between the two groups. Propensity score matching between the two groups was performed and no differences in the above outcomes were found in matched groups. Propensity score matching was performed between patients who had either procedure performed versus no procedure . In similarly matched cohorts, patients who received either procedure had increased LOS (8 vs 6 days), shorter ventilator days (4 vs 6 days) and lower mortality (1.8% vs 4%) compared to patients managed without epidural or paravertebral blocks.

Conclusion: Epidural analgesia has been shown to improve outcomes in trauma patients with blunt chest wall injury and is the preferred management option for patients with multiple rib fractures per EAST guidelines. However, epidural catheters have several contraindications often found in severely injured trauma patients. Paravertebral blocks provide similar outcomes to epidural analgesia and have less contraindications to placement. Patients who received neither form of analgesia had longer ventilator days and increased mortality. Patients with significant chest wall injury should receive epidural or paravertebral analgesia.

Poster # 111

EFAST: Useful or Not?

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Introduction:
The FAST Exam (Focused Assessment with Sonography for Trauma) has become the standard of care for the rapid evaluation of the trauma patient. FAST exam is currently used during the primary survey of the trauma patient to examine the abdomen, pelvis, and pericardial space for free fluid that could represent life threatening hemorrhage. Another common life threatening emergency in the trauma patient is the presence of pneumothorax. Extended FAST (EFAST) is the more recent use of ultrasonography for the detection of pneumothorax, which is fairly new compared to other uses of ultrasound in trauma. The exact sensitivity and specificity of EFAST in detecting traumatic pneumothorax has yet to be investigated.

Methods:
This is a retrospective review of all trauma patients with a diagnosis of pneumothorax who were treated at a large level 1 urban trauma center from March 2013 through July 2014. Charts were reviewed for results of imaging, which included EFAST, chest X-ray, and CT scan. Requirement of tube thoracostomy and mechanism of injury were also analyzed.

Results:
A total of 369 patients with a diagnosis of pneumothorax were identified. 69 patients were excluded as EFAST was either not performed or not documented, leaving 300 patients identified with pneumothorax. 46 patients (15.3%) had penetrating trauma causing pneumothorax, and 254 (84.6%) were due to blunt trauma. 113 patients had clinically significant pneumothorax (37.6%), requiring immediate tube thoracostomy placement. EFAST yielded a positive diagnosis of pneumothorax in 19 patients (16.8%), and all were clinically significant requiring tube thoracostomy. Chest X-ray detected clinically significant pneumothorax in 105 patients (92.9%). Of the patients with an EFAST positive for pneumothorax, 7 were from blunt trauma and 12 were from penetrating trauma. All patients who had a positive EFAST required tube thoracostomy.

Conclusion:
There is little literature on the utility of EFAST for pneumothorax in trauma. The reports on its effectiveness are variable. Our data shows that although specific for clinically significant traumatic pneumothorax, it has poor sensitivity. We maintain that while CT remains the gold standard, chest X-ray is still more sensitive than EFAST for clinically significant pneumothorax. We conclude that the role for EFAST remains limited at this time. Further evaluation is warranted.

Poster # 112

Complete and Sustainable Injury Surveillance at an African Trauma Centre

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INTRODUCTION: Injury surveillance, an essential aspect of modern trauma systems, has been difficult to implement and sustain in low and middle income countries because of cost, limited work force and complexity. In response, we designed a practical, user friendly, mobile electronic Trauma Health Record (eTHR), for point of care data collection by front-line clinicians. eTHR was designed to populate standard clinical reports, while wirelessly populating a deep electronic trauma registry in real time, with standardized data. We hypothesized that this mHealth strategy, when integrated with standard workflow, would for the first time ever, bring sustainable, detailed and high quality injury surveillance to a busy trauma center. **METHODS**: Trauma physicians at a level 1 trauma center in Cape Town were asked to replace standard clinical documentation on paper with documentation on iPads equipped with eTHR. Data were entered along the continuum of trauma care in 3 modules: Trauma Admission Record, Operative Note, and Discharge Summary. Standardized data were used to populate printed clinical notes, and were also transmitted to a real-time electronic trauma registry. After 1 year of continuous use, the registry was evaluated for completeness. eTHR's real time injury scoring accuracy was evaluated with the Revised Trauma Score, Injury Severity Score, and the Kampala Trauma Score. Simple epidemiological and spatial analyses were performed with geographic information systems (GIS). The applicability of eTHR's data to improve trauma center performance, allow epidemiology studies, and drive injury prevention programs was assessed with comparisions to fields outlined by the WHO's Guidelines for Essential Trauma Care (ETC) and the ACS Trauma Quality Improvement Program (TQIP). **RESULTS**: Over 10,000 trauma presentations were accurately documented and promptly analyzed in real-time by the new, clinically integrated electronic injury surveillance system. eTHR approached 100% completeness for essential data elements. eTHR successfully captured all performance improvement data fields recommended by the WHO ETC and TQIP. Epidemiological analyses confirmed a very heavy burden of violence related injury and road traffic injuries and GIS analyses demonstrated clusters of injuries originating mainly from vulnerable and low-income neighborhoods. Analyses of operative data revealed a high proportion and broad spectrum of operative trauma. Delays in operative care were prevalent. Hospital complications were accurately captured and graded. Minor pitfalls with implementation were related to wireless connectivity and in establishing conventions regarding data security and stewardship. Morbidity and mortality reporting and corresponding action proved to be challenging and required close observation of workflow and ongoing coordination with all clinical teams. **CONCLUSIONS**:The accurate capture and simultaneous analysis and reporting of consecutive patients in a busy and under-resourced trauma setting is feasible. Challenges associated with the tremendous volume of trauma seen at this center and the inherent pressures of trauma care, combined with the limited resources available for injury surveillance, have been overcome through the integration of surveillance into clinical work flow, the elimination of duplicated effort, and the instantaneous analysis of electronic data. eTHR, an example of the application of mobile health technologies to the study of key issues in global public health, has the potential to become a sustainable trauma registry for low resource environments.

Poster # 113

AVAILABILITY OF POST-DISCHARGE NURSING FACILITIES: IMPACT ON DISCHARGE DISPOSITION AND LOCATION OF DEATH IN ELDERLY TRAUMA PATIENTS

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Introduction: The majority of the deaths in elderly trauma patients occur after hospital discharge, thus discharge disposition is integral to the overall management of these patients. We hypothesized that discharge disposition was dependent on the availability of post-discharge nursing facilities to hospitals, and that this would affect mortality for this vulnerable population.

Methods: This is a retrospective cohort study of elderly patients sixty-five years and older, who died after traumatic injury from 2006 to 2012. Three publicly available databases were queried for state-level information. The Health Resources and Services Administration's Area Health Resource Files (AHRF) were searched for annual population estimates and healthcare facility information, including number of nursing facility beds in each state. Healthcare Cost and Utilization Project (H-CUPnet) and Centers for Disease Control and Prevention (CDC) Wonder databases were queried for location of discharge and location of death, respectively. Statistical analysis was performed using linear regression models with SPSS software.

Results: Comprehensive data were available for 37 states, in which people over the age of sixty-five made up 13% of the population. H-CUPnet captured 3,566,850 hospital discharges and CDC Wonder captured 385,054 deaths after traumatic injury in the elderly population. Geriatric patients accounted for 47% (range, 37-55%) of all trauma-related discharges, with an upward trend from 2006 (45%) to 2012 (49%). Discharge disposition included nursing or rehabilitation facility (66%), home (31%), and another short-term hospital (3%). Place of death included the hospital (55%), nursing or rehabilitation facility (23%), decendent's home (17%), and hospice facility (5%). States with more nursing facility beds per elderly person had a higher percentage of patients that were discharged to a nursing facility (R^2 =0.248, p= 0.002), and lower percentage of patients that were discharged to home (R^2=-0.300, p=<0.001). Additionally, these states also had a higher percentage of deaths occur in nursing facilities (R^2=0.172, p=0.01) and fewer deaths in the decendent's home (R^2=0.350, p=<0.001). Neither the percentage of inpatient deaths or overall mortality rates were associated with the number of nursing facility beds within each state.

Conclusion: Availability of nursing facilities in each state may affect discharge disposition and place of death in the aging trauma population. Lack of nursing facility availability may shift the responsibility of providing end-of-life care to families, along with the associated social and financial burdens. Efforts to improve quality of care of geriatric trauma patients should extend beyond hospital admission, as these patients remain at high risk of mortality regardless of discharge disposition.

Poster # 114

THE OLDER THEY ARE THE HARDER THEY FALL: INJURY PATTERNS AND OUTCOMES BY AGE AFTER GROUND LEVEL FALLS

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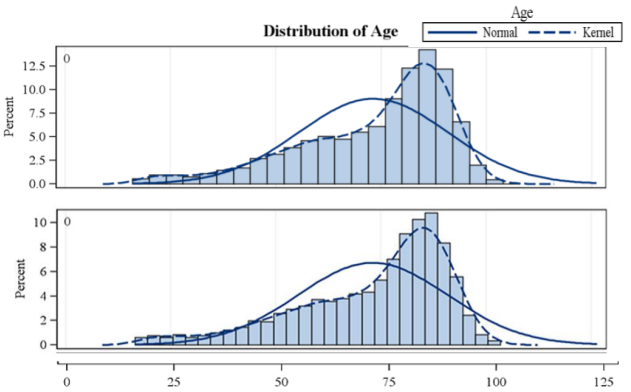
Introduction: As the US population ages, trauma centers are seeing an increasing number of geriatric patients that are more susceptible to injuries even from relatively minor insults such as a ground level fall (GLF). However, as life expectancy increases, people are living in the geriatric age bracket for decades and often using anticoagulation agents for a host of comorbidities. We hypothesize that this patient population is not a homogenous group and we investigated the injury patterns and outcomes after GLF as a function of age and anticoagulation use. We also sought to identify injury patterns in general from this common trauma mechanism.

Methods: A retrospective review of a Level I trauma center's database identified all adult (age $\geq$18) trauma patients admitted after GLFs between 1/2003 and 12/2013. Demographics, injury patterns, anticoagulation use (aspirin, clopidogrel, warfarin, enoxaparin, rivaroxaban) and outcomes were abstracted.

Results: 5088 patients were admitted after GLF over the 10 year period. 4003 patients were 60 years and older and overall 38.2% were male. With each decade, although the ISS did not considerably change (range 7.0-8.6), mortality increased (0.9% at$\leq$ 60yrs vs. 5.5% at $\geq$ 90yrs) and the likelihood of home discharge decreased drastically (73.7% at $\leq$60yrs vs. 18.2% at $\geq$90yrs). Overall, abdominal solid organ injuries were a rare occurrence (0.8%). Age as a continuous variable was associated with an increase incidence of rib and cervical spine fractures. On univariate analysis, aspirin (p= 0.0004) was the only antiplatelet or anticoagulant significantly associated with intracranial bleed. Univariate analysis demonstrated aspirin (p=.0491) or warfarin (p<.0001) use was associated with increased overall mortality.

Conclusion: The geriatric trauma population is not a homogenous group. Certain injury patterns change with increasing age. In our series aspirin use was associated with intracranial bleeds, whereas other agents were not. A seemingly minor mechanism of trauma, GLF is associated with significant morbidity and mortality that increases dramatically with increasing age. The use of certain anticoagulation agents is associated with increased mortality. These patient differences have implications for their evaluation and management.



Poster # 115

CHARACTERISTICS OF PEDIATRIC ASSAULT PATIENTS: A STATEWIDE ASSESSMENT

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Introduction: More than 750,000 pediatric patients are treated in emergency departments for assault every year. In order to improve prevention strategies, a comprehensive understanding of assault against children is needed. Therefore, this study analyzed statewide data from the Ohio Trauma Registry (OTR) from 2007-2012 to describe risk factors for assault in the pediatric population.

Methods: Of 16,938 pediatric trauma patients under 16 years old, assault was identified in 758 patients. Data were compared between patients with assault injuries and non-assault injuries using chi-square tests. Logistic regression evaluated associations between assault and mortality, adjusting for injury severity score (ISS).

Results: The highest proportion (43%) of assault victims was children under 1 year old and 61% were less than 3 years old. By contrast, children under 1 year old accounted for only 7% of non-assault injuries ($p<0.0001$). The majority (68%) of assaults against children occurred in the home compared to 44% of non-assault injuries. Assault victims were more likely to suffer a head injury than children with non-assault injuries (39% vs 23%, $p<0.0001$). Assaulted children were more likely to receive Medicaid (61% vs 31.5%, $p<.0001$), to have a penetrating injury (21% vs. 9%, $p<.0001$), and to receive initial care at a Pediatric Trauma Center (PTC) (62% vs. 25%, $p<0.0001$). Medicaid children were 2.7 times more likely to be assaulted as compared to children with commercial insurance ($p<0.0001$). Black children had 2.3 times the risk of an assault compared to white children ($p<.0001$). Children under 1 year old had 6.4 times the odds of suffering an assault as compared to children aged 14 to 15 years old ($p<.0001$). Assault was more likely to be fatal compared to non-assault trauma after adjusting for ISS (OR=2.4, 95% CI 1.4-4.0). Days between injury and arrival were significantly longer for victims of assault ($p<.0001$).

Conclusion: Pediatric assault victims are more likely to be young (< 3 years old), be injured in the home, receive care at a Pediatric Trauma Center, and die compared to children injured by other means. Although violence prevention strategies for adolescents (gangs, bullying) are important, this younger age group is in dire need of prevention efforts.

Poster # 116

ANTI-TEXTING LAWS DO NOT AFFECT DISTRACTED DRIVING CRASHES

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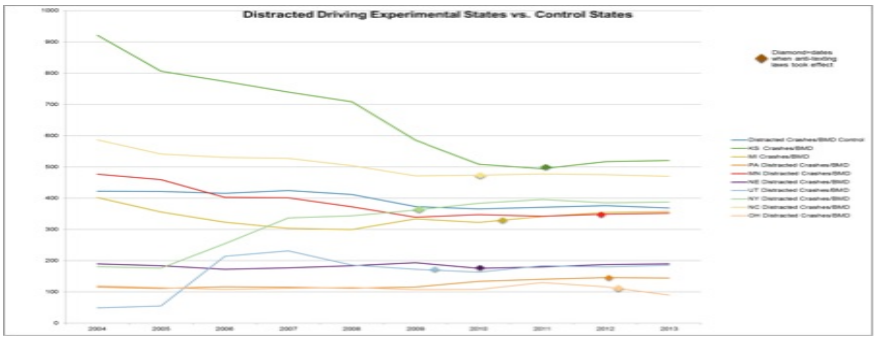
Introduction: Texting while driving is believed to be a significant contributor to distracted driving crashes and deaths in the United States. Forty-four states have passed legislation over the past decade that prohibits texting while driving. But the impact these laws have made on crashes/deaths from distracted driving is unknown.

Methods: We accessed traffic records either by an open records request or through internet-based, publicly available data from the Departments of Transportation for all 50 US states over a ten year time period (2004-2013). We used data from states that included total crashes, fatalities, as well as specific descriptors that could indicate a distracted driving crash (distraction in vehicle, driver inattention, mobile/cell phone use). States without complete data sets for the study time period were excluded. Changes in crashes and deaths before and after anti-texting laws were passed were compared to changes in states where no law was passed during that time frame. Statistical analysis was done with SAS (version 9.3).

Results: 14 states were included in the study (AZ, KS, MI, MN, NE, NY, NC, OH, OK, PA, SD, TX, UT, and VA). Within all states, total miles driven went from 1317 billion miles driven (BMD) to 1298 BMD (p=.001). Total annual text messages sent rose from 56 billion in 2004 to 2.19 trillion in 2012 (p=.001). Total crashes in all 14 states fell from 1815/BMD to 1588/BMD (p=.001). Total fatalities fell from 15.29/BMD to 11.51/BMD (p=.001), and distracted driving crashes fell from 314.7/BMD to 294.3/BMD(p=.001). Deaths attributed to distracted driving fell from 2.52/BMD to 1.62/BMD (p=.001). Of the 14 states, 5 did not have any sort of statewide anti-texting law implemented during the study period (control states). Control States had an average decrease in distracted driving crash rates from 422.5/BMD to 368.9/BMD (p=.001), and an average decrease in distracted driving deaths from 2.90/BMD to 2.51/BMD (p=.001). 9 of the 14 states had anti-texting laws passed during the study period (KS, MI, PA, MN, NE, UT, NY, NC, OH). Distracted driving crashes did not decrease after laws were passed for any state except Ohio (116.4/BMD to 89.9/BMD, p=.001) (figure 1).

Conclusion: There is a general decline in both total crashes and distracted driving crashes in all 14 study states during the study period. Anti-texting and driving laws were not associated with any decrease in distracted driving crashes in 8 of the 9 states.



Poster # 117

BEHAVIORAL PREDICTORS OF SEATBELT USE: RESULTS OF THE WORLD'S LARGEST BEHAVIORAL SURVEY

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Introduction: Seatbelt use saves lives, reducing the morbidity and mortality of motor vehicle accidents. Unfortunately, studies show up to 20% of adults *still* do not use seatbelts regularly. Seatbelt laws appear to increase rates of seatbelt use, but ultimately seatbelt use is a personal decision which may be affected by multiple social and demographic factors. In this study, we use the Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS) to investigate seatbelt utilization. The BRFSS is the world's largest telephone survey with over 500,000 respondents in 2011. To our knowledge, no prior study of this magnitude has investigated behavioral predictors of seatbelt use. We hypothesized that low education level, and other high-risk behaviors such as smoking and alcohol consumption would be associated with decreased seatbelt use.

Methods: To investigate our hypothesis, we queried 506,467 records from the Center for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS). We defined our outcome as respondents who reported they always, or nearly always wear seatbelts. Multivariate logistic regression was performed to analyze which independent variables were associated with higher rates of seatbelt use. Significance was set at $p< 0.05$.

Results: The results of our analysis are shown in Table 1. Data revealed that male sex, young age and high-risk behaviors such as smoking and drinking were associated with not using a seatbelt. Higher levels of education, marital status and access to health care were independent predictors of frequent seatbelt use.

Conclusion: Multiple independent variables are associated with seatbelt use, including education, marital status, access to health care, smoking and drinking habits, gender and age. This is the largest study to date addressing this important public health concern. The results from this study could help target interventions toward the subgroups of patients who are least likely to use seatbelts, and thus would most benefit from further outreach.

Table 1.

Variable	Sample Size	P-value	Odds ratio	95% CI
Not a Heavy Drinker	433,133	<0.0001	1.59	(1.45 - 1.73)
Did not graduate high school	40,475	<0.0001	0.41	(0.37 - 0.45)
High school graduate	134,141	<0.0001	0.46	(0.43 - 0.50)
Attended college or technical school	124,658	<0.0001	0.62	(0.57 - 0.67)
Male	179,703	<0.0001	0.52	(0.49 - 0.55)
Married/Member of unmarried couple	258,566	<0.0001	1.49	(1.37 - 1.62)
Divorced/Widowed/Separated	137,913	0.0131	1.12	(1.02 - 1.22)
Age 18 to 24	20,096	<0.0001	0.7	(0.63 - 0.79)
Age 25 to 44	104,775	<0.0001	0.81	(0.75 - 0.87)
Any health care coverage	407,970	0.0029	1.12	(1.04 - 1.20)
Former smoker or never smoked	383,217	<0.0001	1.66	(1.56 - 1.77)

Poster # 118

TYPE 1 DIABETES INCREASES ODDS OF VENOUS THROMBOEMBOLISM FOLLOWING TRAUMATIC INJURY

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Introduction: Incidence of venous thromboembolisms (VTE) is relatively low in trauma populations, due to widely accepted screening and prophylaxis protocols. However, VTE remains responsible for substantial mortality and morbidity. Diabetes mellitus (DM) is associated with endothelial dysfunction, altered platelet activation, increased coagulability, and decreased fibrinolysis, promoting the formation of thrombi. Studies examining the relationship between DM and VTE have been limited to non-trauma populations, with varying results. We sought to determine if DM was an independent risk factor of VTE among trauma patients. **Methods**:The registries of two metropolitan Level I trauma centers were retrospectively reviewed for consecutively admitted trauma patients over a 5 year period. Demographics, comorbidities including risk factors for VTE, injury region and severity, and incidence of VTE were compared between DM and non-DM populations using univariate analysis. Covariates were included in a stepwise logistic regression (entry, exit criteria: $p<0.2$, 0.07) to identify independent predictors of VTE. Results were stratified by age (<65, ≥65) and DM type (Type 1, Type 2). **Results**: Of 19511 total patients, 10% (1962) reported pre-injury DM (34% Type 1; 66% Type 2). Incidence of VTE varied by age and DM type (**Table 1**). Overall incidence of VTE was 2.43%, compared with 3.26% in the DM population. Among patients of all ages, Type 1 DM trended towards being independently associated with increased VTE ($p=0.07$); Type 2 DM was not predictive of VTE ($p=0.40$). In patients <65 years, however, Type 1 DM was predictive of VTE (Adjusted Odds Ratio, 2.19; 95% CI, 1.19-4.02); additional predictors are listed in **Table 2**. Type 2 DM was not associated with VTE in patients <65 years. In patients ≥65 years, neither type of DM was predictive of VTE; however, covariates found to be significant included sex, obesity, injury severity, coagulopathy, multiple traumas, receipt of a surgical procedure, and placement of a central line.

Conclusion: Type 1 DM carried an increased risk for VTE, although apparent in younger trauma patients only. In addition to Type 1 DM, our analysis reestablished known risk factors of VTE. This finding suggests Type 1 DM should be included as a risk factor in trauma protocols, necessitating the administration of VTE prophylaxis.

Table 1: Incidence of VTE

	All Ages (n=19511)	Age <65 (n=11973)	Age ≥65 (n=7538)
Overall	2.43%	2.33%	2.60%
Any diabetes	3.26%	3.69%	3.02%
Type 1 DM	3.89%	4.59%	3.38%
Type 2 DM	2.94%	3.08%	2.87%

Table 2: Predictors of VTE in trauma patients under the age of 65

Covariates	AOR	95% CI	P
Type 1 Diabetes	2.19	1.19-4.02	0.01
Male	1.50	1.11-2.03	0.008
Obesity	2.61	1.75-3.89	<0.0001
Injury Severity Score ≥ 16	2.71	2.01-3.66	<0.0001
Limb Injury	1.76	1.34-2.33	<0.0001
Receipt of a Surgical Procedure	3.63	2.60-5.07	<0.0001
Placement of a Central Line	2.74	2.00-3.76	<0.0001

AOR, Adjusted Odds Ratio; CI, Confidence Intervals

Poster # 119

MOTORCYCLES AND ORGAN DONATION: DO HELMET LAWS IMPACT ORGAN AVAILABILITY?

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Introduction: Motorcycles (MC) have been referred to as "donor-cycles" due to the increased risk of severe TBI following MC crashes. MC helmet use has been shown to reduce the overall death rate and the incidence of lethal and non-lethal head injuries after MC crashes. A recent study has suggested a correlation between mandatory MC helmet laws and the death rate of those on transplant waiting lists secondary to decreasing the available cadaveric donors and thereby increasing wait times. The objective of this study was to examine the impact of MC helmet laws on the process metrics of solid organ transplantation.

Methods: UNOS wait list data for patients awaiting kidney (CRTx) or liver (OLTx) transplantation as well as data for those receiving deceased donor transplants in 2013 were collected. This was collated with state specific data from the Insurance Institute for Highway Safety comparing the existence of universal helmet laws (UHL), population, land area, average yearly precipitation, climate zone, state speed limit, number of registered motorcyclists, total mileage driven and number of fatal motorcycle accidents. Univariate analysis of organ wait times greater than two years and deceased donor transplants with respect to UHL was performed for CRTx and OLTx. Multivariate linear regression models were constructed predicting time on the wait list and number of deceased donor transplants performed based on the state specific factors listed above.

Results: As of February 2015, there were 125,545 patients awaiting CRTx or OLTx with UNOS. 48.5% and 42.3% of patients awaiting CRTx and OLTx respectively have been listed for greater than 2 years. Overall, the number of registered MC riders per population correlates with the number of deceased donor transplants performed. There are significantly more MC deaths as a function of the overall state population (1.5/100k vs. 1.1/100k; $p<0.005$) in states without UHL. When evaluated based on registered motorcyclists alone, however, there is no significant difference between MC deaths in states without and with a UHL (55.9/100k vs. 73.7/100k; $p=0.25$). On univariate analysis, a UHL was associated with a significantly higher frequency of wait time greater than 2 years for both CRTx and OLTx. However, UHL were not associated with fewer deceased donor transplants per population or per listed patient. On multivariate linear regression modeling, a UHL was a small but significant predictor of wait longer than 2 years for kidney transplant, but not for liver. For both models, population density, registered motorcyclists per population, and average yearly precipitation were all stronger predictors of wait time then UHL.

Conclusions: Although helmet laws are associated with longer waiting times for CRTx and OLTx, state variation in wait list times is explained by factors beyond just the presence or absence of a UHL. UHL are not associated with fewer deceased donor transplants per capita. Motorcyclists do contribute disproportionately to the pool of transplant organs, but at this time there is no evidence to suggest that helmet laws independently are responsible for increased wait time.

Poster # 120

TRAUMA SEVERITY AND NOT THE SOCIO-ECONOMIC VARIABLES DETERMINES THE SURVIVAL AFTER PENETRATING TRAUMA IN A MEDIUM-INCOME COUNTRY

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Introduction: Survival after severe trauma is lower in low- and middle-income countries. Poor quality of pre-hospital care, lack of insurance, and differential access to high quality care are possible explanations. The aim of this study was to evaluate the effect of lack of insurance, the pre-hospital times and the nature of the hospital (public or private), in survival after violent penetrating trauma in a middle-income country.

Methods: Information was collected prospectively. Patients aged 17 years or older, taken directly from the scene during the first six hours after the trauma were included. Deaths on admission were excluded. Logistic regressions (LMR) were used to control for confounders.

Results: A total of 320 penetrating trauma patients were treated; 201 in a private hospital and 119 in a public hospital from June to December 2012. There were 305 (95.3%) males. Median age was 26 years (IQR 21-35). Medians and IQR of RTS, ISS and PS were 7.55 (5.97-7.84), 18 (16-25), and 0.96 (0.85-0.99) respectively. A total of 64 (20.0%) subjects were uninsured. Median of pre-hospital time was 56 min (IQR 32-96). Death occurred in 69 cases (21.6%). Univariable analyses demonstrated that mortality did not differ significantly between hospitals (OR 1.14, IC95% 0.65-1.99), Mortality trended to be higher in the uninsured patients (OR 1.75, IC95% 0.94-3.23), and diminished as the pre-hospital time was longer (0.75 IC95% 0.58-0.95). After adjusting for age, ISS and TRISS, these associations disappeared, and only the severity indexes remained as significant predictors (Table).

VARIABLE	OR (95%CI)	P
Public hospital	1.13 (0.52-2.45)	0.75
Uninsured	1.41 (0.60-3.33)	0.43
Pre-hospital time (quartiles)	0.83 (0.61-1.14)	0.25
Age in years	1.00 (0.97-1.04)	0.80
ISS	1.09 (1.04-1.12)	0.00
TRISS	0.49 (0.40-0.60)	0.00

Conclusions: In a middle-income country with well-established intra-hospital care, mortality in penetrating trauma was determined by the severity of the trauma. Type of hospital, lack of insurance and pre-hospital time affected it only marginally.

Poster #121

VICTIMS AND INJURY PATTERNS IN GERIATRIC ASSAULT: ANALYSIS USING THE NATIONAL TRAUMA DATABANK

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Introduction: Non-accidental injuries in geriatric patients, including physical elder abuse, are common and can result in severe traumatic injury. Unfortunately, it is under-recognized by health care providers, often due to challenges in differentiating between assault and accidental injury, made more difficult by the normal physiologic changes that occur with aging. Currently, no national description of injury patterns in severe non-accidental geriatric injury exists. Improved understanding of injury patterns that distinguish between geriatric assault and accidental injury is critically needed. To comprehensively describe injury patterns, treatment, and outcomes of geriatric assault victims treated at US trauma centers.

Methods: We conducted a retrospective analysis of the 2006-2012 National Trauma Data Bank. We identified cases of non-accidental injury admitted to trauma centers in patients aged ≥60 using ICD9 codes 962-968, 995 and E-codes V15.41, V15.42, V71.81.

Results: 526 victims of non-accidental injury were identified among 47,962 total trauma admissions of patients aged ≥60. 83% of assault victims were male, in comparison with 48% of non-assault trauma patients. Assault victims had a mean age of 66±6 years compared to a mean age of 74±9 years among non-assault patients. Among assault victims, 21% had ≥3 co-morbidities, with only 2% of patients having reported dementia. 33% reportedly had recent alcohol or drug use when assaulted. The median injury severity score (ISS) was 9 (4-16), and the incidence of severe trauma (ISS≥16) was 35%. Median length of stay was 5 days (IQR 3-7), 42% required ICU care, and in-hospital mortality was 6%. Injuries were most commonly on the head (24%) and lower extremities (20%). 50% had injuries on ≥3 body regions.

Conclusion: Geriatric assault victims admitted to trauma centers are much more commonly men and are typically younger than other trauma patients, with frequent recent alcohol/drug use. Very few assault victims have dementia or are older women suggesting that severe assault injuries to these patients may currently be poorly recognized or that these patients may not be admitted to trauma services for treatment. Severe geriatric assault-related injuries are most commonly to the head and lower extremities, with many patients having injuries on multiple body regions.

Poster # 122

URBAN PRIVATE VEHICLE TRANSPORT IS INDEPENDENTLY ASSOCIATED WITH HIGHER SURVIVAL FOR VICTIMS OF PENETRATING TRAUMA

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Introduction:

The role of pre-hospital trauma care of injured patients remains a topic of considerable debate. Previous studies have evaluated the impact of mode of transport, transport times, and the intensity of pre-hospital procedures on morbidity and mortality following trauma. However, these studies are primarily from either a single center or the entire country, including all geographic regions (urban, suburban, rural) equally. These previous results are inconsistent and local pre-hospital systems continue to have varying protocols. We aimed to identify the optimal mode of transport for individuals suffering penetrating injury within urban trauma systems.

Methods:

Using the American College of Surgeons National Trauma Databank (NTDB), we identified all adult (age ≧ 16) gunshot wound and stab wound patients presenting to level 1 and level 2 trauma centers from 2010 to 2012. Cases were limited to those occurring in the 100 most populous US metropolitan areas using unblinded facility identification and hospital zip code information. Patients were included if they were transported directly to the trauma center by ground emergency medical services (EMS), police, or private transportation and had complete records with regard to the primary outcome of mortality. Mortality rates for pre-hospital mode of transport were calculated and the odds ratio of risk-adjusted mortality for each transport mode were derived.

Results:

Of 108,582 patients, 88,826 (81.8%) were EMS, 17,284 (15.9%) were private, and 2,472 (2.3%) were police. The overall mortality rate was 10.2%. After adjusting for age, gender, race, injury severity, presenting systolic blood pressure, presenting heart rate, Glasgow Coma Scale Motor score, year of admission, and insurance status, private vehicle patients were significantly less likely to die when compared to EMS patients (OR=0.48, 95% CI: 0.40-0.58). There was no mortality difference between EMS and police transported patients (OR=0.94, 95% CI: 0.66-1.34).

Conclusion:

By using facility identifier and hospital zip code data in the NTDB, we demonstrate that in urban settings, private transport is associated with higher survival compared to EMS transport for victims of penetrating trauma. Although similar findings have been previously reported, this is the first time the data have been restricted to the urban setting. By limiting these analyses to large metropolitan areas, the results can stimulate the evaluation and optimization of pre-hospital care within urban trauma systems nationwide.

Poster # 123

AUDITING THE AUDITORS: DO AUDIT FILTERS HAVE VALUE IN A MATURE TRAUMA PROGRAM?

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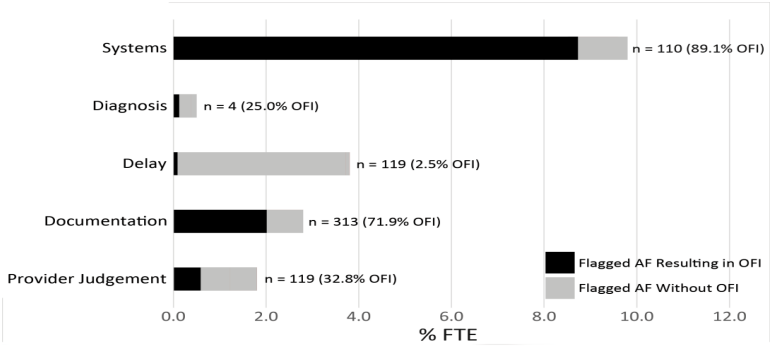
Introduction: Trauma audit filters (AF) are used to ensure compliance with processes of care and are thought to improve outcomes and reduce adverse events. AF are based on expert consensus, rather than evidence. The resources required to document a trauma program's compliance with AF are substantial. No study has validated the use of AF as a means of improving processes of care or clinical outcomes. We sought to examine the value of AF within a mature, Level I trauma program.
Methods: We performed a retrospective descriptive study of all trauma patients admitted to a Level I trauma center from 7/2012-6/2014. Of 5244 patients, 532 (10%) were selected for review based on noncompliance with at least one of 18 AF from a total of 108 system-required AF. Three trauma surgeons and the trauma nurse director estimated the utility and feasibility of 108 AF. AF with the highest and lowest predicted value (utility divided by feasibility) were reviewed and categorized as documentation, delay, diagnosis, provider judgment, or systems-related. The primary outcome was the presence of an AF-identified opportunity for improvement (OFI). The secondary outcome was the presence of an AF-identified complication. Value was defined as the number of OFI or complications per AF divided by the time in hours required to identify and adjudicate noncompliance. Cost was converted to a full-time equivalent (FTE) of a trauma registrar.
Results: A total of 665 events of AF noncompliance occurred in 532 patients over the study period. Of these, 365 (55%) resulted in OFI. Administrative AF identified 68% of OFI (250/365). Noncompliance with an AF identified a complication only 1% of the time (7/665). No mortalities were identified by an AF. The estimated cost required to identify and adjudicate the selected 18 AF was 0.67 FTE. Noncompliance with one of the systems filters (nursing issues) had the highest FTE (0.25) and identified 63 (88%) OFI and 4 (5%) complications. Noncompliance with the delay in orthopedic treatment AF had the second-highest FTE (0.13) but identified only 1 OFI (1%) and no complications.
Conclusion: Routine identification and adjudication of the selected 18 AF at a mature Level I program was costly (0.67 registrar FTE). Low-value AF related to delay or administrative issues warrant either elimination or only periodic review. Further study is required to determine the value and cost savings of these options.



Poster # 124

TWELVE YEARS OF WAR: EXPERIENCE WITH 18,752 ADMISSIONS AT A MILITARY LEVEL IV FACILITY

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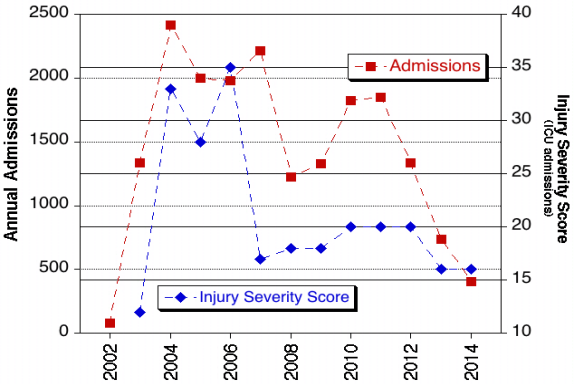
Introduction: Twelve years of conflict have been associated with significant evolution in care of injured service members driven by improved field, surgical and critical care techniques, and rapid global aeromedical and critical care transport. Essential to care in this paradigm is a comprehensive military Level IV facility (milLIV) allowing further stabilization of the wounded prior to subsequent transport to the United States. We describe the experience of a milLIV in caring for over 18,000 admissions over more than a decade of conflict.

Methods: Data from patient experience at our milLIV facility was obtained from both local and theater trauma registries from Jan 2002- Dec 2014. Information collected included mechanism of injury, injury severity, and injury patterns. In-hospital information reported included number and type of procedures, length of stay in the intensive care unit (ICU) and hospital, and mortality.

Figure: Annual Admissions and ICU admission ISS for 2002 thru 2014



Results: A total of 18,752 trauma patients were admitted to our milLIV from Jan 2002-Dec 2014, with overall milLIV mortality of 0.66%. Casualty source included Iraq (56%), Afghanistan (37%), and other (6%). The top 3 causes of injury were blast (51%), gunshot wound (17%), and motor vehicle crash (9%). Amputation affected 7% of patients, and 6% of patients suffered perineal injuries. Twnety-nine percent of patients were admitted to the intensive care unit. Injury Severity Scores (ISS) were ≥ 25 in 11%,16-24 in 11%, 10-15 in 22%,with the remainder presenting with ISS <10. Fifty-five percent of patients underwent at least one operation at the milLIV facility. Average time from injury to arrival at milLIV was 2.7 days, and average length of stay at the milLIV was 3.5 days. The last 3 years have seen decreased total admissions and decreased severity of injury.

Conclusion: A military Level IV facility is a critical component of the military trauma system, allowing delivery of outstanding care to severely injured combat casualties. A major difference between milLIV and civilian trauma facilities is the transient nature of patients admitted to milLIV.

Poster # 125

DIFFERENCES IN HOSPITAL OUTCOMES FOLLOWING TRAUMATIC INJURY FOR PATIENTS EXPERIENCING IMMEDIATE TRANSFER TO A LEVEL I TRAUMA FACILITY VERSUS RESUSCITATION AT A CRITICAL ACCESS HOSPITAL (CAH)

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Introduction: Effective and timely treatment of rural trauma patients is an important component in a statewide trauma system. Critical access hospitals (CAH) serve a key role in providing medical care to these rural patients. The purpose of this study was to assess effectiveness of CAHs in initial care of trauma patients.

Methods: A 5-year retrospective chart review was conducted of all trauma patients ≥18 years of age who sustained a traumatic injury and were subsequently either sent transported directly to a level I trauma facility, or to a CAH and subsequently transferred to a level I trauma facility after initial resuscitation. Data collected included demographics, injury severity score (ISS), transportation mode, initial vital signs and GCS, life-saving procedures performed (chest tube, needle decompression, intubation). Outcomes were evaluate for patients who were or were not seen initially at a CAH.

Results: Of the 1478 trauma patients studied, 1084 were transferred from a CAH while 394 transported directly to the level I facility. Sixty-seven point three percent of patients had an ISS score 1-15, 18.4% had an ISS score of 16-24, and 14.3% had an ISS score ≥25. Patients transported directly to the level I hospital were younger, more severely injured, were ventilated longer and had longer ICU and hospital length of stays. Overall mortality was 7.3%; 59% of those who died were transferred while 41% of those who died were brought directly from the scene (p=0.001). Logistic regression analysis identified that older age, higher ISS, and lower GCS were all associated with a higher odds ratio of death, while transfer from CAH was not. Further, multiple regression analyses were conducted to analyze the effect of transfer from CAH on total hospital days, ICU days, and ventilator days while adjusting for the effects of shock, GCS, and ISS. Transfer from CAH was associated with a decreased length of hospital stay and was not associated with increased ICU days or ventilator days.

Table	CAH Transfer (mean)	Direct Transport (mean)	P-Value
Age, years	52.4	42.2	<0.001
ISS	11.4	16.3	<0.001
ICU Days	2.9	5.3	<0.001
Ventilator Days	2.0	4.7	<0.001
Hospital Days	4.8	7.3	<0.001

Conclusion: Following regression analyses, patients initially transferred to a CAH to undergo assessment and resuscitation prior to transfer to a level I trauma facility did not have increased mortality, hospital stay, ICU days, and ventilator days. This contradicts prior studies indicating increased mortality in patients treated at nontrauma centers initially.

Poster # 126

DEVELOPMENT OF A MEDICAL INFORMATION TRANSMISSION SYSTEM USING SMARTPHONES TO HASTEN HEMOSTATIC TREATMENT

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Introduction: It is still challenging to shorten the time from injury to medical intervention for severe trauma. Severe trauma patients with hemorrhagic shock require hemostatic surgery or transcatheter arterial embolization (TAE) as quickly as possible. Meanwhile, the hospital trauma team needs exact medical information to prepare treatment. To resolve this matter, we have established the physician on-boarding HEMS system and developed the Real-Time Movie Transmission for EMS system using smartphones (REMOTE) with NTT Docomo Inc. The trauma team can monitor the dispatched physician's activity through REMOTE. This study aimed to evaluate the effect of transmission of patients' information between the dispatched physician and trauma team through REMOTE on shortening the time from injury to hemostatic procedure.
Patients and Methods: HEMS aviation and medical records were investigated retrospectively. Both "Reducing time of sending medical information" and "Shortened time of starting hemostasis" were compared between the previous period (PP) group without REMOTE (July 2012 to June 2013) and the late period (LP) group with REMOTE (July 2013 to June 2014).
Results: In this study, 633 cases in the PP group and 562 cases in the LP group were eligible for analysis. The time between HEMS request and sharing medical information were 31.6 min and 16.1 min in the PP and LP groups ($p<0.001$), respectively. Hemostatic procedures including emergency transfusion, thoracotomies, laparotomies, TAE, or pelvic external fixation were carried out in 29 cases in the PP group and in 38 cases in the LP group. The time between hospital arrival and TAE in the LP group was significantly shorter than that in the PP group (89 min vs. 58 min, $p=0.040$).
Discussion: This study revealed that REMOTE can immediately provide detailed medical information from the scene to the hospital trauma team including patients' severity, vital signs, and necessity of hemostasis treatment on hospital arrival. This system can also contribute to timely preparation of a massive transfusion protocol and operating room stand-by, and will be expected to improve the survival rate of severe trauma patients.

Poster # 127

HETEROGENEITY IN TRAUMA REGISTRY DATA QUALITY: IMPLICATIONS FOR REGIONAL AND NATIONAL PERFORMANCE IMPROVEMENT IN TRAUMA

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Introduction: Performance improvement (PI) is an important goal in the current practice environment. Led by TQIP, efforts are underway to expand PI efforts beyond the individual center to regional and national levels. The foundation for effective PI is quality data capture and resultant data homogeneity. The National Trauma Database has five standardized audit filters (AF) designed to identify patient records with potential erroneous data. Three AF are focused on complications, one on comorbidities and one on unexpected mortality. To build a foundation for statewide PI, the Georgia Committee on Trauma (COT) instituted standardized AF analysis in all Level I and II centers in the state to ascertain data quality and homogeneity.

Methods:Level I and II trauma centers in the state of Georgia performed AF reports monthly from July 2013 - Sept 2014. Identified patient records were reviewed to determine whether there was erroneous data abstraction and the nature of any error identified. Percent yield was defined as number of errors divided by number of charts captured. Data was collated by the COT and analyzed at a monthly and quarterly level. No organized educational activity directed at registry personnel or front line providers was performed.

Results:5 Level I and 7 Level II trauma centers submitted complete data sets. Over 15 months, 21,115 patient records were subjected to AF analysis. AF captured 2901 (14%) records and individual review yielded 549 (2.5%) records with erroneous data. Individual AF performance is listed in the table. AF 1 had the highest number of records identified and AF 3 had the highest percent yield. Individual center error rates ranged from 0.4% to 7.2%. Comparing quarters 1 and 2 (July 2013-Dec 2014) to quarters 4 and 5 (April 2014-Sept 2014), 8 of 12 centers had statistically significant decrease in error rates (Range 3-7% decreased to 0.1 to 1%, $p<.0001$). . The three AFs that focused on complications yielded the most errors in 1, 6, and 0 and the highest percentage yield in 0, 3 and 2 centers respectively. The AF focused on comorbidity yielded the most errors in 3 and the highest percentage yield in 5 centers. The AF focused on mortality yielded the most errors and highest percentage yield each in 2 centers. The most common missed complications were pneumonia, urinary tract infection and surgical site infection. The most common missed comorbidities were hypertension, diabetes and alcoholism.

Audit Filter (Focus)	Records (%)	Errors (%)	Percent Yield
1 (Complications)	865 (4%)	119 (0.5%)	13.7%
2 (Complications)	778 (4%)	165 (0.7%)	21.2%
3 (Comorbidities)	573 (3%)	138 (0.6%)	24.1%
4 (Complications)	437 (2%)	104 (0.4%)	23.8%
5 (Unexpected Mortality)	248 (1%)	23 (0.1%)	9.2%
Totals	2901 (14%)	549 (2.5%)	18.9%

Conclusions: 1. In the state of Georgia, the type and rate of erroneous data in trauma registries varies between centers, leading to heterogeneity in data quality and suggests that targeted educational opportunities exist at the institutional level. 2. In and of itself, standardized AF assessment significantly improved data quality in the majority of participating centers.

Poster # 128

COMPARING THE INCIDENCE OF INJURY COMPLICATIONS ACROSS TRAUMA SYSTEMS: A RETROSPECTIVE COHORT STUDY

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Background: Complications of patient care represent a major burden in terms of mortality, morbidity, and resource use and have a negative impact on long-term functional capacity and quality of life. The positive influence of trauma systems on patient mortality has been widely documented but their impact on patient complications is less clear. Currently, there is significant variation in the level of integration of trauma systems across Canada. This context provides a unique opportunity to compare injury outcomes across health care jurisdictions with varying commitment to trauma care. The objective of this study was to evaluate inter and intra-provincial variations in the incidence of complications across Canada for major trauma admissions.

Methods: We conducted a retrospective cohort study using the Canadian *National Trauma Registry*. Patients admitted for major injury (Injury Severity Score >12) to any level I or II trauma center in Canada between 2006 and 2012 was included. Multilevel logistic regression models were used to estimate the incidence of major complications adjusted for age, injury mechanism, anatomical injury severity and physiological parameters. Analyses were performed for all trauma and then stratified by type of injury (traumatic brain injury, thoracoabdominal, spine). Extensive sensitivity analyses were performed.

Results: The study population included 76,949 patients of whom 9917 (12.9%) had at least one major hospital complication including 6.8% with pneumonia, 1.1% with renal failure, 1.3% with DVT, 1% with PE, 1.1% with sepsis, 1.4% with ARDS, and 0.3% with a stroke. Crude incidence of at least one complication varied from 7.2% to 19.3% across trauma centers and 7.2% to 19.3% across provinces. After adjustment for case mix, the incidence of complications varied between 8.1% and 18.1% across trauma centers and between 9.1% and 16.1% across Canadian provinces.

Conclusion: The incidence of major complications varies significantly across Canadian trauma centers and Canadian provinces, even after adjustment for patient case mix. Variations may in part be due to heterogeneity in reporting complications but we anticipate that this potential bias was largely avoided by restricting analysis to major complications. Information on systematic differences in structures and processes of care is needed to elucidate the reasons behind observed variations. This information could be used to inform quality of care improvements and improve injury outcomes in Canada.

Poster # 129

FALL FROM STANDING OR FALL FROM GRACE: A CRITICAL ANALYSIS OF 24 YEARS OF LOW LEVEL FALLS IN GERIATRIC TRAUMA PATIENTS AT A LEVEL I TRAUMA CENTER

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Introduction: Geriatric patients (age 65 and older) are comprising a progressively larger proportion of the patients admitted for traumatic injuries. Many of these are due to low level falls. Our goal was to define the characteristics of this group and identify opportunities for improvement in their care and outcomes.

Methods: The trauma registry of our level I trauma center was queried for all patients admitted over the 24 years of its existence. Patient parameters including age, gender, mechanism, ISS, mortality, comorbidities (2008-2013), and outcomes were analyzed. Wilcoxon u-tests and chi-square were used to identify differences between groups.

Results: A total of 29,151 trauma patients were treated between January 1989 and December 2013. Of these, 28,583 (98.1%) had complete records and were included in subsequent analysis. There were 5,214 geriatric patients (18.2%). Overall, low level falls accounted for 2,495 (47.9%) of this group; increasing from 22/282 (7.8%) from 1989-1994 to 1,867/2,995 (62.3%) from 2008-2013 ($p<0.0001$) (Figure 1). Compared to geriatric patients with other forms of blunt trauma, patients with low level falls tended to be older, female, with a higher ISS, more comorbidities, and more dependent upon hospital discharge (Table 1).

Conclusion: Geriatric patients with low level falls represent a unique subset of trauma patients. As this patient group is more medically complex, they may benefit from early aggressive multimodality care including geriatric medicine and palliative care.

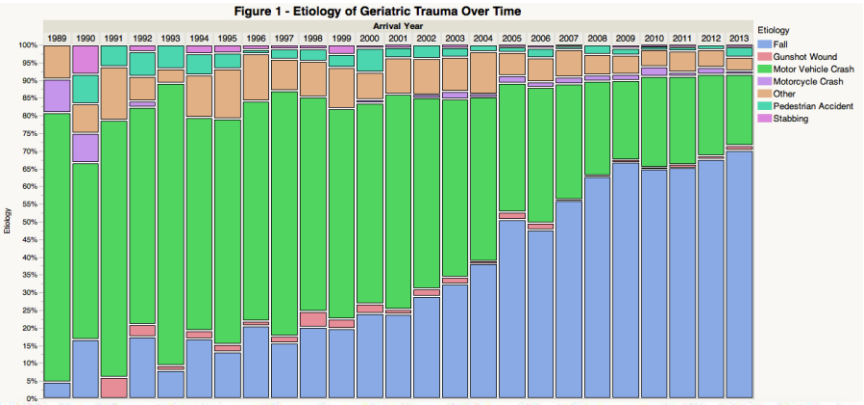

Table 1 - Characteristics of Low Level Falls vs Other Blunt Trauma in Geriatric Patients

	Low Level Falls	Other Blunt Trauma	p-value
Total Patients	2495 (47.9%)	2548 (52.1%)	
Median Age	81	73	<0.0001
Male Gender	975 (39.1%)	1517 (59.5%)	<0.0001
Median ISS	12	9	<0.0001
Mortality	287 (11.5%)	268 (10.5%)	0.26
Neurologic Comorbidities (2008-2013)	588/1867 (31.5%)	91/1048 (8.7%)	<0.0001
Cardiac Comorbidities (2008-2013)	695/1867 (37.2%)	278/1048 (26.5%)	<0.0001
>2 Comorbidities (2008-2013)	760/1967 (40.7%)	262/1048 (25.0%)	<0.0001
Discharged to Home Without Assistance	798 (32.0%)	1281 (50.3%)	<0.0001
Discharged to Skilled Nursing Facility	995 (39.9%)	471 (18.5%)	<0.0001

Poster # 130

FINANCIAL IMPACT OF MINOR INJURY TRANSFERS ON A LEVEL I TRAUMA CENTER

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Introduction: Trauma centers receive transfers from other hospitals for a higher level of care. We hypothesized that patients transferred from outside institutions with minor trauma would impart a negative financial impact on the receiving trauma center.

Methods: We performed a retrospective review of all trauma patients admitted to our urban Level I trauma center from Oct 1, 2011 through Sept 30, 2013. Patients were categorized as minor trauma (MT) if they did not require operation within 24 hours of arrival, did not require ICU admission, did not die, and had a hospital LOS < 24 hours. Transferred patients (Tx) and non-transfers (NTx) (those received directly from the field) were compared with respect to insurance status and hospital margin. Student's t-test and z-test for proportions were performed for data analysis.

Results: A total of 6,951 trauma patients were identified (Tx n=2228, NTx n=4724). MT-Tx (n=440, 19.7%) was compared to MT-NTx (n=689, 14.6%). Hospital margins of MT-Tx patients and MT-NTx patients were $2,227 and $2,569 respectively ($p$=0.22). Percentages of uninsured/underinsured (charity care or self pay) for MT-Tx and MT-NTx were 27.3% and 36.1% respectively (p=0.002).

Conclusion: By our criteria, 19.7% of transfers and 14.6% of non-transfers can be categorized as minor trauma. Such transfer patients are associated with a positive hospital margin for the trauma center that is similar to that of the non-transfer group. The data also demonstrate a lower percentage of uninsured/underinsured in the transferred group. However, the data also suggest that a significant proportion of transfers (1 in 5) are being sent to Trauma centers with minor traumatic injuries that might be managed at the referring institution, potentially leading to a diversion of finite resources from seriously injured patients at the trauma center.

Poster # 131

THE PRECIPITOUS DECLINE OF INFERIOR VENA CAVA FILTER USE IN A MATURE TRAUMA SYSTEM

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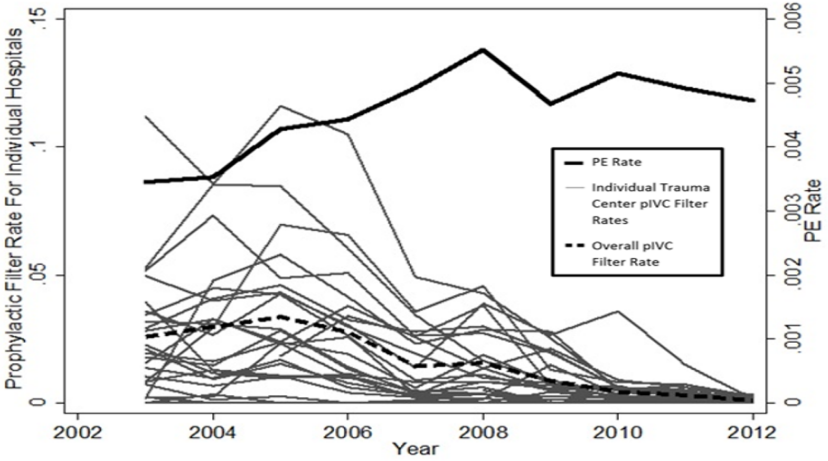
Introduction: Prophylactic inferior vena cava (pIVC) filter placement for pulmonary embolism (PE) prevention is a controversial practice within the trauma community. Previous population-based studies have noted a marked increase in IVC filter use over the past 20 years. We sought to determine the practice pattern and outcomes of pIVC filter placement in a mature, statewide trauma system.

Methods: All 2003-2012 admissions to Pennsylvania Trauma Systems Foundation-accredited trauma centers were extracted. Pulmonary embolism (PE) was defined as ICD-9 415.01, and IVC filter as ICD-9 38.7. An IVC filter placed prior to or without an impending PE was considered a prophylactic IVC (pIVC) filter. An IVC filter placed following a PE was classified as a therapeutic IVC (tIVC) filter. Rates of IVC filter placement, PE, and mortality were analyzed.

Results: Over the 10-year study period, 337,103 trauma patients were admitted, 5,044 IVC filters were placed, and 1,558 PEs were identified. Of patients with PEs, only 20.0% (N=312) received a filter; 86.2% of which were therapeutic filters (N=269). The majority of filters placed were prophylactic (N=4,775; 94.7%). IVC filter placement peaked between the years 2004-2006 in the majority of trauma centers in PA. Subsequently, IVC filter use has dropped significantly throughout the state while the rate of PE has remained relatively constant (Fig. 1). Overall mortality rate was 5.07%. PE was significantly associated with a higher rate of mortality (8.47%, $p<0.001$), although patients with PEs were more severely injured on average than those who did not develop a PE.

Conclusion: While the use of pIVC filters is on the decline in Pennsylvania's trauma system, the rate of PE is remaining relatively constant. Taking this association into consideration, it appears pIVC filters have limited value in preventing PE development, while imposing a significant economic burden on the healthcare system.



Poster # 132

SIDE OF PELVIC FRACTURE PREDICTS LATERALITY OF PELVIC HEMORRHAGE: IMPLICATIONS FOR RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION

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Introduction: Pelvic fracture hemorrhage significantly impacts the morbidity in the injured patient. Definitive hemorrhage control may require arterial embolization, a procedure not often immediately available. The purpose of this study was to: 1) determine if pelvic fracture pattern on initial pelvic imaging could predict the laterality of angiographic-demonstrated pelvic hemorrhage; and 2) to examine common iliac artery diameters in these bleeding patients to determine if smaller endovascular occlusion balloons could be used instead of large diameter aortic balloons for temporizing pelvic hemorrhage.

Methods: A retrospective review of an imaging registry identified all patients at a Level 1 trauma center over a 10 year period (January 2004- October 2014) who underwent arterial embolization for pelvic hemorrhage control after injury. Pelvic fractures on initial plain films were categorized according to laterality (right, left, bilateral). Laterality of bleeding source (right, left, bilateral) as demonstrated during pelvic arterial embolization was also recorded. Angiogram and CT imaging were reviewed to determine the diameter of the distal aorta and the common iliac artery on the side of hemorrhage. The success of CT imaging in determining the laterality of pelvic hemorrhage in patients with bilateral pelvic fractures was also investigated. Exclusion criteria included prophylactic pelvic embolization or the absence of a pre-embolization pelvic plain film.

Results: One hundred and three patients were retrospectively reviewed of which 85 met inclusion criteria. Mean patient age was 44.8. Concomitant abdominal and head injuries were present in 32% and 23% of patients respectively. Thirty-two of the 38 patients (84%) with unilateral pelvic fractures on plain film had a source of hemorrhage identified on the same side of fracture during angioembolization (20 unilateral and 12 bilateral bleeds). Of the 47 patients with bilateral fractures, 17 (36%) had bilateral hemorrhage, 15 (32%) left sided hemorrhage, and 15 (32%) right sided hemorrhage. Of these 47 patients, 26 received CT imaging prior to pelvic embolization. CT imaging was successful in identifying the laterality of pelvic bleeding in 21 of the 26 patients (81%). The 25 th, 50th, 75th, and 90th percentile common iliac artery diameter on the side of hemorrhage in the study population was 8.1, 9.1, 10.0, and 12.0 mm, respectively. The 25th, 50th, 75th, and 90th percentile terminal aortic diameter on the side of hemorrhage was 14.0, 15.0, 17.0, 20.0 mm, respectively.

Conclusion: In patients with angiographic-demonstrated pelvic hemorrhage, unilateral fractures on initial X-ray imaging have a moderately high sensitivity in predicting the laterality of pelvic arterial hemorrhage. In patients with bilateral pelvic fractures, CT imaging has a moderately high sensitivity in predicting the laterality of arterial pelvic bleeding. The majority of patients with pelvic arterial bleeding have common iliac artery diameters that are amendable to utilizing endovascular balloons that fit within small (5 or 6 French) sheaths used for subsequent arterial embolizations. This may facilitate the use of endovascular balloon occlusion techniques as an initial temporizing bridge to pelvic arterial embolization in the hemorrhaging trauma patient.

Poster # 133

VASCULAR SURGICAL EXPERTISE AT LEVEL I TRAUMA CENTERS: CAUSE FOR CONCERN

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Introduction: Fewer open vascular cases in residency and fellowship training and the retirement of experienced surgeons portend a shortage of open vascular surgical expertise. We examined the extent to which these trends are impacting Level I trauma centers.

Methods: Trauma medical directors at ACS COT-verified and state-designated Level I trauma centers completed an online survey in 2015 of vascular injury volume, vascular trauma call panels, trauma surgeon vascular experience, and vascular certification. Management of extremity vascular injury and blunt popliteal artery injury were assessed as were concerns regarding the capabilities of vascular surgeons and the future availability of vascular expertise.

Results: Completed surveys were obtained from trauma medical directors representing 96 (51.3%) of 187 Level I trauma centers. Mean annual center patient volume was 2,520 with a mean rate of 0.5% for non-thoracic aortic vascular repairs. Isolated extremity vascular injury was managed with covered stents in 32% of centers and 24% noted attempted endovascular management of popliteal artery occlusion. Both resulted in complications including amputation. Concern regarding a vascular surgery colleague's expertise was reported in 16%. Ninety-one percent of respondents expressed concern regarding future availability of vascular expertise.

Conclusion: Decreasing open vascular expertise impacts a significant number of Level I trauma centers. Recruiting more surgeons with open vascular expertise to deal with this problem is unlikely to succeed. A more realistic solution is providing trauma surgeons with training opportunities in vascular exposures and techniques.

Trauma Surgeons at Level I Trauma Centers
50% perform vascular repairs
3% board-certified in vascular surgery
15% centers $\geq$ 1 trauma surgeon with vascular boards
88% centers with vascular trauma call panel

Trauma Medical Directors' Recommendations	
Recruit surgeons with vascular experience	(**43%**)
Send colleague to vascular surgery fellowship	(**5%**)
Additional training in vascular techniques	(**28%**)

Poster # 134

TRAUMA PATIENT ACCESS TO VASCULAR SURGERY CAPABLE HOSPITALS MAY BE A LOOMING PROBLEM.

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Introduction: General surgery residents currently receive very little in the way of vascular operative experience. However, practicing general surgeons and trauma surgeons may still be tasked with the urgent care of vascular injuries in trauma patients. We sought to determine how frequently vascular surgical procedures are performed at U.S. trauma centers to quantify the need for vascular surgical expertise. We hypothesized that urgent vascular surgical cases represent a large proportion of trauma cases, and that this would hold true across all regions and American College of Surgeon (ACS) verified trauma center levels.

Methods: We conducted a retrospective analysis of the National Trauma Data Base for the year 2012. Patients with general surgical and vascular procedures were identified using the International Classification of Diseases, 9th Revision (ICD-9) procedure codes. We included only cases performed in the first 24 hours after emergency department arrival to isolate the need for urgent intervention. We also limited the analysis to patients >18 years of age and patients with severe injuries defined by an injury severity score (ISS) of 15. Selected analyses were compared to similarly constructed 2002 NTDB data.

Results: The total number of patients that met criteria for the analysis was 177,228. Of these 15,316 (9%) underwent a general surgery procedure, 7,775 (4%) had a vascular procedure, and 6,081 (3%) had both a general surgery and vascular procedure. The average age of the population undergoing surgery was 50.2, and 31% were female.

A majority of the cohort received treatment at Level I/II trauma centers vs. Level III/IV centers (96% vs. 4%). Furthermore, vascular surgical procedures were performed more frequently on patients at Level I/II centers (8.2% vs. 1.4%, $p<0.001$). This was compared to the year 2002, when there was no difference in the rate of vascular procedures between Level I/II and Level III/IV centers (6.4% vs. 7.6% respectively, $p=0.142$).

Vascular surgery was frequently performed in community trauma centers (4,868 cases, 7.9% of patients) , but was still lower when compared to University hospitals (7,682 cases, 8.5% of patients, $p<0.001$). There was no difference in the rate of vascular surgery cases by U.S. census region.

Conclusion: : Vascular surgery remains a common need for injured patients. This is true for community and university settings, and across US regions. Compared to 2002, fewer patients received vascular surgery procedures at Level III/IV centers, suggesting a concentration of vascular skill sets at Level I/II centers. Future workforce needs will need to address the reduction in vascular skill sets to support the needs of the injured population.

Poster # 135

ASSOCIATION BETWEEN BLOOD TRANSFUSION AND RISK OF VTE IN PATIENTS WITH ISOLATED ORTHOPEDIC TRAUMA

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Introduction: Venous thromboembolism (VTE) is a significant cause of morbidity and mortality in orthopedic trauma patients. Growing evidence suggests risks linked to transfusion, and restrictive transfusion practice to a hemoglobin ≥ 7.0 is well established. This study seeks to examine whether orthopedic trauma patients receiving packed red blood cells (pRBC) are at increased risk of VTE formation compared to those who are not transfused.

Methods: The institution's trauma registry was queried for all patients admitted between January 1, 2008 and December 31, 2013 with isolated orthopedic injuries as defined by area injury scores in non-extremities ≤2. Variables considered included age, gender, obesity, injury severity score (ISS), transfusion status and timing (intra-,peri- or non-operative), surgical status,hemoglobin prior to transfusion, hospital length of stay (HLOS) and documented VTE. Patients were then stratified by transfusion status. Because of differences between cohorts as measured by T test(Table 1) a logistic regression was used to measure the independent effect of each variable on VTE formation.

Results: A total of 311 patients were admitted with isolated orthopedic injuries during this period and included for analysis. Excluding patients with intraoperative transfusion or symptomatic anemia, 44 patients were transfused and analyzed, including 22 with Hg ≥ 7.0. Of the 44 transfused, 12 had VTE documented (27.3%) as compared to 12 of the 255 (4.7%) patients in the non-transfusion group with VTE for an unadjusted odds-ratio of 7.59 (Table 1). Logistic regression showed a statistically significant odds ratio of 5.70 (p = .0011) for transfusion status as an independent predictor of VTE incidence (Table 2).

Conclusion: Transfusion in orthopedic trauma patients is an independent risk factor for VTE formation. This risk should be strongly considered in treatment decisions and the practice of transfusing patients with Hg ≥ 7.0 should be reevaluated. Prospective study and further investigation into potential causal mechanisms are warranted.

Table 1 - Group Demographics

	Not transfused	Transfused	P value
N	255	44	
ISS	8.1	9.7	.0058*
Age	42.4	47.8	0.0679
% Female	62.5	45.5	.0335*
% Obese	28.6	31.8	0.6682
% Surgery	64.7	88.6	.0021*
HLOS	6.9	14	<.0001*
% VTE	4.7	27.3	<.0001*

Table 2 – Logistic Regression Summary

Variable	Likelihood Ratio Chi Square	P value
Age	1.43	.233
ISS	3.98	.0461*
Obesity	1.79	.181
Male Gender	4.92	.0265*
Surgery	0.001	.974
HLOS	12.34	.0004*
T status	10.60	.0011*

Poster # 136

IDENTIFICATION OF RISK FACTORS FOR THE DEVELOPMENT OF DECUBITUS ULCERS DESPITE STANDARD SCREENING METHODOLOGY AND PROPHYLAXIS IN TRAUMA PATIENTS

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Introduction: Pressure ulceration prevention has been emphasized over the past several years in inpatient hospital settings with subsequent decreases in development of decubitus ulcers (DU). However, there remains a subset of trauma and burn patients that develop DU despite standard screening methodology and prophylaxis to include skin care, nutrition, support devices, and frequent repositioning. The goal of this study is to identify the population that subsequently develops DU despite routine care.

Methods: Demographic and DU data were collected over a 5-year period from June 2008 to May 2013. Patients diagnosed with DU upon arrival in the trauma bay were excluded from analysis. An ordinal logistic regression of DU stage was used to estimate odds ratios (ORs) and associated 95% confidence intervals (CIs) for the association between characteristics of interest and odds of DU. A backwards selection process was used to select the most parsimonious model.

Results: During the study period, 14,616 trauma patients were admitted and had available data. A total of 124 patients (0.85%) that did not have any sign of pressure ulceration upon presentation went onto develop DU during the course of their hospitalization despite routine screening and prophylaxis. Factors associated with development of DU included spine AIS >3 (OR 5.72, CI 3.63-9.01), mechanical ventilation (OR 1.95, CI 1.23-3.10) and age 40-64 (OR 2.09, CI 1.24-3.52) and increased further with age ≥ 65 (OR 4.48, CI 2.52-7.95). Interestingly, head injury AIS >3 was protective from development of DU (OR 0.56, CI 0.32-0.96). Hypotension and shock defined as systolic BP <90 mmHg and base deficit less than -6 were not associated with development of DU. Additionally, BMI was not associated with DU development.

Conclusion: Spinal injuries, age ≥40, and mechanical ventilation predict development of DU for a subset of patients despite conventional prophylaxis and screening. Advanced prevention methods such as low air loss mattresses for these patient subgroups should be considered immediately upon identification of these risk factors during the hospital course.

Poster # 137

FACIAL TRAUMA AND SIX MONTH PSYCHOLOGICAL OUTCOMES

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Introduction: The face plays a critical role in one's sense of self and body image, and as such acquired facial trauma likely has a substantial psychological response. Abundant research demonstrates an association between acquired facial trauma and anxiety, depression, acute stress, and posttraumatic stress disorder. Acquired facial trauma has also been associated with lower life satisfaction, lower health-related quality of life, and a more negative self-perception of body image. The primary objective of this study is to examine the psychological outcomes of patients with facial trauma six months after acute hospitalization from a traumatic injury.

Methods: This cohort consisted of patients from a larger prospective longitudinal study consisting of individuals ≥18 years of age admitted to the trauma service of a Level I trauma center for ≥ 24 hours. Demographic and injury-related variables were collected from the trauma registry. Facial injury was determined by ICD-9 codes and divided into facial fracture and soft tissue injury. Outcomes, measured at baseline (hospitalization) and at 6 months, included depression, posttraumatic stress disorder (PTSD), and health related quality of life. Depression was measured using the Patient Health Questionnaire (PHQ-8), PTSD using the Primary Care PTSD Screen (PC-PTSD) and PTSD Checklist-Civilian Version (PCL-C), and health related quality of life using both the Physical Health Component measure and the Mental Health Component measure of the Veterans RAND 12-item Health Survey (VR-12). Paired t-tests and McNemar's change tests were used for analysis.

Results: 57 patients were included in this analysis. Of these, 32 had at least 1 fracture and 25 had only soft tissue injuries. The average injury severity score (ISS) was 15.1. Eighteen percent (N=10) of the injuries were caused by aggravated assault or gunshot wound, 21% (N=12) were caused by fall, 44% (N=25) by motor vehicle or motorcycle collision, and 18% (N=10) were caused by other means. Of the entire sample, 30% were positive for depression at baseline and 42% were positive at six months post injury. For PTSD symptoms, 35% of the sample endorsed symptoms at baseline and 28% endorsed symptoms at six months. A significant increase in the rate of depressive symptoms for patients with soft tissue injuries was found ($p = 0.0047$), however this trend did not hold true for those with facial fractures ($p = 0.7$). PTSD and pain were not significantly correlated with either type of facial injury at 6 months. Physical health quality of life decreased significantly for both groups ($p < 0.001$), yet mental health quality of life only decreased significantly for patients with soft tissue injury ($p=0.0012$).

Conclusions: In our study, sustaining a facial trauma was associated with considerable rates of both depression and PTSD symptoms at the time of hospital admission as well as six months post trauma. Differences emerged, however, in rates of depression and mental health quality in life in those with only soft tissue injuries, suggesting that these injuries produce more of a psychological impact than a facial fracture without soft tissue injury. Given the high rates of mental health consequences following facial trauma, individuals with these injuries should be screened for both depression and PTSD symptoms early after injury and provided with resources for treatment.

Keywords: Traumatic Injury, Facial Trauma, Depression, Posttraumatic Stress Disorder

Poster # 138

VENOUS THROMBOEMBOLIC RISK AFTER VENOUS INJURY: IMPACT OF LIGATION VERSUS REPAIR

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Introduction: Venous injury in trauma patients is a significant risk factor for venous thromboembolism (VTE: deep venous thrombosis and pulmonary embolism). However, it remains unclear whether the type of surgical management (ligation or repair) impacts the incidence of VTE. The aim of this study was to compare VTE occurrence after venous injury managed by ligation compared to repair.

Methods: After IRB approval, the National Trauma Data Bank was queried for patients undergoing a surgical intervention for venous injury (1/2007-12/2012). Data abstracted included demographics, injury data, and outcomes. The incidence of DVT, PE and VTE was compared between the ligation and repair groups.

Results: A total of 6,295 patients met inclusion criteria (ligation: 3,257, repair: 3,038). Mean age 35.1 years, 82.3% male, 73.6% penetrating mechanism, 39.0% ISS>15, and 60.4% sustained a peripheral venous injury. Patients in the ligation group developed DVT (8.9% vs 5.0%, $p<0.001$), PE (1.7% vs 1.0%, $p=0.021$) and VTE (9.9% vs 5.9%, $p<0.001$) more frequently than the repair group. After adjustment using multivariate analysis, ligation was associated with a significantly higher incidence of DVT (OR=1.80, 95% CI: 1.43-2.26, $p<0.001$) and VTE (OR=1.69, 95% CI: 1.36-2.09, $p<0.001$) when compared to repair.

Conclusion: Patients who underwent venous ligation for injury are at a higher risk of VTE compared to those who underwent repair. Prospective validation of these findings is warranted.

Poster # 139

SIMPLIFIED APPROACH FOR DIAGNOSIS OF PERSISTENT INFLAMMATION, IMMUNOSUPPRESSION, AND CATABOLISM SYNDROME IN SEVERE TRAUMA PATIENTS AND ITS CLINICAL OUTCOME

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Introduction: Persistent inflammation, immunosuppression, and catabolism syndrome (PICS) is a recently proposed concept describing the complicated clinical course of severe trauma patients. However, the diagnostic criteria of PICS are not fully established and research of its clinical outcome is limited.

Methods: We retrospectively reviewed trauma patients who stayed in the ICU for more than 10 days between 2010 and 2014. Patients were divided into PICS and non-PICs groups based on the following simplified criteria: C-reactive protein (CRP) level greater than 10 mg/dl on day 10, albumin level less than 3.0 g/dl on day 10, and evidence of infection within the first 10 days in the ICU. We compared clinical characteristics and outcomes between the two groups.

Results: Of 93 enrolled patients, 41 were diagnosed with PICS (44.1%). Victims of blunt trauma accounted for 97.8% (91/93) of the enrolled patients. Median age of the patients was 60 [IQR: 42.5–71.5] years old, and the median injury severity score (ISS) was 35 [29–43]. There were no differences in patient characteristics between the two groups. Univariate analyses revealed that the in-hospital mortality (PICS group: 12.2% vs. non-PICS group: 1.9%, $p = 0.045$), duration on mechanical ventilation (median; 18 vs. 15 days, $p = 0.019$) and length of stay in the hospital (75 vs. 59 days, $p = 0.01$) was significantly higher in the PICS group than the non-PICS group. However, there was no difference in 30-day mortality (4.9% vs.1.9%, $p = 0.423$) between the two groups. On multivariate analysis, the PICS group was significantly associated with recurrent infection after day 10 (odds ratio 2.83, 95% confidence interval, 1.09 to 7.39, $p = 0.033$).
Conclusion: Severe trauma patients who experience a prolonged ICU stay, high CRP level and low albumin level on day 10, and episodes of infection within the first 10 days are likely to have more complicated hospital course and poor long-term outcomes, which are characteristic of PICS. This streamlined diagnostic model will help identify patients with PICS early and accurately.

Poster # 140

ELECTRONIC MUSCLE STIMULATION INCREASES BLOOD FLOW VELOCITY OF THE POPLITEAL AND FEMORAL VEINS IN INTENSIVE CARE

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Introduction: Deep vein thrombosis (DVT) is a major complication in critical care. In cases of major trauma, patients are forced to be on long-term bed rest and are at high risk for DVT. Guidelines recommend early administration of prophylactic agents to prevent DVT in such high-risk patients. However, this involves risk of hemorrhage. An electronic muscle stimulation (EMS) device is recently being used for rehabilitation of immobilized people. Rhythmic change of blood flow may have a prophylactic effect for DVT. The purpose of this study was to evaluate the effects of the EMS on blood flow of the lower limbs.

Methods:This prospective observational study included patients with traumatic brain injury, spinal cord injury, pelvic fracture, stroke, and sepsis on mechanical ventilation for more than 3 days (EMS group). In each patient, the EMS device was attached to the posterior calf and anterior thigh. The stimulation strength was set for the ankle to move grossly in planter flexion. We checked maximum blood flow velocities of the popliteal and femoral veins before and during EMS as well as in patients not undergoing EMS as a control group.

Results:We enrolled 31 patients (62 legs) (EMS group n=11, control group n=20) with a mean age of 62.9±19.94 years. The median APACHE2 score was 19.0 [11.0-24.0, n=31] and ISS score was 25.0 [17.0-36.0, n=13]. The median velocity of the popliteal vein during EMS was 23.8 [13.8-38.0] cm/s and at rest as 12.6 [9.7-18.2] cm/s ($p<0.001$). The median velocity of the femoral vein during EMS was 25.0 [18.3-32.7] cm/s and at rest was 19.6 [14.2-27.6] cm/s ($p<0.001$). There was no major complication related to EMS.

	EMS	Rest	p value
The velocity of Pop.V	23.8 (13.8-38.0)	12.6 (9.7-18.2)	<0.001
The velocity of CFV	25.0 (18.3-32.7)	19.6 (14.2-27.6)	<0.001

Conclusion:EMS was safe and significantly increased blood flow in the popliteal and femoral veins. Prevention of blood stasis with EMS may have the prophylactic potential for DVT without risk of hemorrhage in critical care.