Poster # 1

COLON INJURY IN DAMAGE CONTROL SURGERY: IS IT SAFE TO DO A DELAYED ANASTOMOSIS?

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Introduction: Delayed colonic anastomosis with damage control laparotomy (DCL) has been considered as an alternative to colostomies during a single laparotomy (SL) in high-risk patients. The literature, however, suggests increased leak rates with DCL between 7-27%. Reported risk factors for anastomotic leak vary widely across studies. We sought to evaluate the regional experience to better elucidate risk for anastomotic leak in DCL.

Methods: A multi-center retrospective cohort study was performed as a collaboration of 3 metropolitan Level I trauma centers. Traumatic colon injuries from January 2006 through June 2014 were included. Exclusion criteria included rectal injuries and death within 24 hours of presentation. Demographics, comorbidities, injury characteristics, complications, medical and operative interventions were compiled and compared between the SL and DCL groups. Logistic regression analysis was performed for any complication with a minimum of 20 occurrences. We utilized regional hospital council readmission data to identify patients who presented after discharge to any member hospital within 1 year of the index admission to better capture complications.

Results: Out of 267 qualified patients, penetrating injuries accounted for 69%, and overall mortality rate was 4.9%. Fifty-six patients (21%) underwent DCL, many with multiple injuries. A total of 179 had a primary repair (26 in DCL), 89 had a resection and anastomosis (28 in DCL), 18 had an end colostomy (10 in DCL), and 9 had a diverting loop ileostomy (2 in DCL). One-third (19) of DCL patients had injuries repaired in a delayed manner during subsequent laparotomies. Patients selected for DCL were statistically more likely to be hypotensive, transfused >6 units of packed red blood cells, receive 3-4 liters more crystalloid, and suffer from adult respiratory distress syndrome, pneumonia, acute kidney injury, and death. Only 5 leaks were identified (1.8%), proportionately distributed between DCL and SL ($p=1.00$), along with 3 enterocutaneous fistulas (ECF, $p=0.51$). Given the small incidence, we were unable to perform meaningful analysis to determine risk factors for leaks. No difference was seen in the incidence of intraabdominal abscesses ($p=0.13$) or surgical site infection (SSI, $p=0.70$) between DCL and SL. DCL patients with concomitant liver injuries had a trend toward increased risk of abscess formation ($p=0.06$), whereas SL patients with pancreas injuries were at increased risk of abscess ($p<0.01$). No difference in complications was noted in DCL patients who underwent definitive colon repair at the initial operation compared to a subsequent operation.

Conclusion: Our regional data do not suggest any increase in complication rate for anastomotic leaks, ECF, SSI, or intraabdominal abscesses within the DCL cohort despite one-third of patients having delayed repair. This is contrary to previous lower-powered studies, which demonstrated higher leak rates. A large multi-institution prospective trial would be indicated to further characterize the risks of DCL in colon trauma.

Poster # 2

IS IT SAFE? NON-OPERATIVE MANAGEMENT OF BLUNT SPLENIC INJURIES IN GERIATRIC PATIENTS

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Introduction:Previous surgical dogma dictated that older age was a contraindication to non-operative management (NOM) of blunt splenic injuries (BSI). This was based on documented increased failure rates and the concern for increased mortality associated with failure. As many studies have shown the efficacy of NOM, there has been an increased use of this treatment strategy in the geriatric population. However, no recent study has been published assessing the safety of NOM of BSI in this population.

Methods:We performed a retrospective analysis of data from the National Trauma Databank (NTDB) from 2014 and identified young (age < 65) and geriatric (age ≥ 65) patients with a BSI. Patients who underwent immediate splenectomy (within 6 hours of admission) were excluded from the analysis. Outcomes were failure of NOM and mortality.

Results:We identified 18,917 total patients with a BSI, 2,240 (12%) geriatric patients and 16,677 (88%) young patients. 14% of geriatric patients and 13% of young patients underwent immediate splenectomy and were excluded from further analysis. Geriatric patients failed NOM more often than younger patients (6% vs. 4%, $p < 0.0001$). On logistic regression analysis, high ($\geq$16) ISS was the only independent risk factor associated with failure of NOM in geriatric patients (OR=2.8, CI=1.8 – 4.4, $p < 0.0001$). There was no difference in mortality in geriatric patients who had successful versus failed NOM (11% vs. 15%, $p = 0.22$). Independent risk factors for mortality in geriatric patients who underwent NOM included admission hypotension (OR=1.5, CI=1.0 – 2.4, $p = 0.049$), high ISS (OR=3.8, CI=2.6 – 5.8, $p < 0.0001$), low GCS (OR=5.0, CI=3.5 – 7.2, $p < 0.0001$), and pre-existing cardiac disease (OR=3.6, CI=2.0 – 6.6, $p < 0.0001$). However, failure of NOM was not independently associated with mortality (OR=1.4, CI=0.8 – 2.6, $p = 0.25$).

Conclusion:When compared to younger patients, geriatric patients had a higher but acceptable rate of failed NOM of BSI, and failure rates in our geriatric population are lower than previously reported. Failure of NOM in geriatric patients is not associated with an increase in mortality. Based on our results, NOM of BSI in geriatric patients is safe.

Poster # 3

REGIONALISTAION OF MAJOR TRAUMA IN ENGLAND IMPROVES THE OUTCOME OF SEVERE LIVER INJURIES.

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Introduction: Regionalisation of major trauma in England in April 2012 re-directed severely injured patients to Major Trauma Centres (MTC) whilst less injured patients went to Trauma Units (TU). This has delivered an overall improvement in survival, however outcomes in specific injuries have not been evaluated. Severe liver trauma (Grade IV and V) is recognised to have high mortality although contemporary national outcome for patients in England with these injuries have not previously been reported. The aim of this study was to define the contemporary mortality associated with severe liver injury in England, as well as, to investigate the effect of the regionalisation of major trauma on outcome for patients with severe liver injuries.

Methods: Trauma Audit Research Network (TARN) data for patients, who presented between April 2010 and March 2015, were between 16 and 65 years old, alive on admission and had injury severity score (ISS) $\geq$ 15 and at least liver injury, were retrieved. Outcome (mortality) was compared before and after regionalisation and also between MTCs and TUs.

Results: A total of 1790 patients met the inclusion criteria. 449 patients had a liver injury of grade IV or above. The overall mortality for severe liver trauma in England since April 2012 is 19%, and this has improved significantly since regionalisation (19% vs 31%; Odds ratio [OR], 1.82; 95% confidence interval [CI], 1.16 -2.8; P=0.007). Similarly, the outcome of trauma patients with severe liver injury in MTCs has improved since regionalisation (16% vs 27 %; OR 0.51; 95% CI, 0.29-0.89; P=0.01). Patients with severe liver injury admitted to TUs after April 2012 had higher mortality compared to those admitted to a MTC (36% vs 16%; OR, 0.33; 95% CI, 0.17-0.65).

Conclusion: The mortality of severe liver trauma remains high, however regionalisation of major trauma in England is associated with improved outcome in this patient group. Further improvements could be delivered with better triage to MTCs.

Poster # 4

THE ROLE OF PROCALCITONIN IN THE DECISION TO CLOSE OPEN ABDOMENS AFTER DAMAGE CONTROL LAPAROTOMY

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Introduction: Damage control laparotomy (DCL) followed by temporary abdominal closure, resuscitation and planned re-laparotomy is used to manage critically injured patients who cannot be closed primarily at the initial operation. Patients that undergo successful primary fascial closure at the initial operation may have a biomarker profile that is distinct from those who are managed with an open abdomen. The purpose of this study was to evaluate whether procalcitonin (PCT), as a modulator of immunologic function, is associated with delayed fascial closure after laparotomy.

Methods: This is a prospective, observational study of patients requiring exploratory laparotomy for blunt or penetrating injury at an urban Level 1 trauma center. Serial tissue, serum and peritoneal effluent samples were collected during each operative intervention from initial laparotomy to abdominal closure. Demographic and physiologic data, as well as local and systemic biomarker and quantitative bacteriology data were analyzed and compared among patients that achieved definitive fascial closure at the initial operation versus those that did not. Outcome measures included overall survival, hospital length of stay, intensive care unit length of stay, ventilator days, time to abdominal wound closure, wound complications, and discharge disposition.

Results: Sixty-one trauma patients met inclusion criteria for the study, 31 of these were managed with DCL while 30 underwent definitive primary fascial closure at the initial operation. In addition to increased ICU and overall length of stay, univariate analysis revealed that DCL patients had higher peak serum and wound effluent PCT levels (23.0 ± 7.8 ng/ml vs 0.11 ± 0.02, $p<0.01$). Peak PCT was also found to correlate with increasing bacterial isolates in peritoneal fluid samples (R 2 0.08, p 0.03). Among the DCL patients, median time to abdominal closure was 4 days (IQR-5). Wound effluent PCT was found to correlate with time to definitive closure. Stepwise regression analysis identified peak serum PCT and mechanism of injury as independent risk factors for DCL (OR 41.3, [CI-3.65-5195] and OR 3.50 [1.26-10.6] respectively).

Conclusion: Elevated peak serum and wound PCT appear to be associated with delayed fascial closure after DCL. Identifying risk factors for delayed fascial closure may help to avoid the complications of multiple attempts to close, and optimize the chance of a successful planned staged ventral hernia. This could shorten time to recovery and potentially prevent some of the complications seen after DCL in this population.

Poster # 5

EARLY MOBILIZATION OF PATIENTS WITH NON-OPERATIVE LIVER AND SPLEEN INJURIES IS SAFE AND COST EFFECTIVE

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Introduction: Currently there is no standard for the management of non-operative solid organ injuries. Previous studies have established that early ambulation is safe, however our aim is to show that early mobilization (EM) decreases hospital length of stay (LOS), ICU LOS, and cost without increasing adverse events.

Methods: Prior to 2011, patients with non-operative liver and spleen injuries (LSI) were managed with a minimum of 3 days of bed-rest. In 2011 the protocol was amended such that patients with a stable hemoglobin may be out of bed the morning after admission for grade 1 and 2 injuries, and after at least 24 hours for grade 3 or higher injuries, or those with free intra-peritoneal fluid on CT. A retrospective chart review was conducted looking at all patients with LSI from 2008 through 2011, when prolonged bed-rest (PBR) was observed, and from 2011 through 2014, when EM was instituted. Data collection consisted of length of bed-rest, hospital LOS, ICU LOS, failure of non-operative management (NOM), and mortality. Patients that were excluded were those with penetrating trauma, confounding injuries to other body systems requiring management above and beyond what would have been required for their LSI, patients who went straight to the operating room from the emergency department for their LSI, and those patients for whom complete data is unavailable in the medical record. Analysis was performed using a student t-test to evaluate length of bed-rest, hospital LOS, and ICU LOS.

Results: Prior to initiation of EM in 2011 there were 300 patients with LSI, of which 211 were excluded, leaving 89 eligible for the study. From 2011-2014, there were 251 patients with LSI, 152 were excluded, and 99 left meeting study criteria. Between the two groups, there was no significant difference in the male to female ratio, age, grade of injury, ISS, or mechanism of injury (MOI). Data analysis demonstrated that the PBR group had a significantly longer average hospital LOS, 5.89 days, versus 3.36 days in the EM group. There was also a statistically significant difference in the mean ICU LOS, 4.59 days versus 1.75 days in the PBR and EM groups, respectively. Using current hospital data, the average cost for a single ICU day is $13,709 and $7,136 for a regular bed. Extrapolating this data to the EM group, that's an average savings of $38,897 per ICU stay and $10,533 per stay in a regular room. There was only one failure of NOM in either group. This was a patient in the PBR group who required a splenectomy 2 days following spleen embolization (performed on the day of admission). Both the PBR and EM groups had a 2% mortality rate.

Conclusion: This study examines a homogenous patient population, at a level I trauma center over several years. We found that not only is EM in non-operative LSI safe, it also lowers hospital LOS, ICU LOS, and decreases healthcare costs. In addition, these effects were demonstrated without adversely affecting failure of NOM or patient mortality.

Poster # 6

DECREASING THE UTILIZATION OF DAMAGE CONTROL LAPAROTOMY: A QUALITY IMPROVEMENT PROJECT

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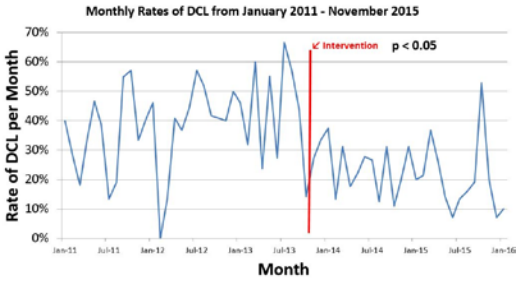
Introduction: Our institution has published damage control laparotomy (DCL) rates of 38% and documented the substantial morbidity associated with the open abdomen. Despite this, our DCL rates remained unchanged and there were patients undergoing DCL who may have safely undergone definitive laparotomy (DEF). The purpose of this quality improvement (QI) project was to decrease our rate of DCL while monitoring morbidity and mortality.

Methods: A prospective cohort of all emergent trauma laparotomies from 11/2013-10/2015 (QI period) were followed. During year one, trauma faculty completed report cards immediately following each DCL. During year two, our group collectively reviewed DCLs every other month to determine which patients may have safely undergone DEF. Morbidity and mortality of the QI patients were compared to our published historical control (HC) group of patients undergoing emergent laparotomy (01/2011-10/2013).

Results: The DCL rate in the HC group was 38%. A significant DCL rate decrease was observed immediately upon beginning the QI project, with an overall rate for the QI group of 23% ($p<0.05$). Of the 101 DCLs performed during the QI period, 27 were judged to have been patients who could have safely undergone DEF, leaving a 17% theoretical rate of DCL during the QI period. For surgeons with ≥25 laparotomies, surgeon-specific rates of DCL ranged from 13-44%. Of the seven surgeons observed, four had a DCL rate above 17%. These four did not differ in age, years in practice, or residency program, but were more likely to have completed fellowship at our institution (100% v 0%, p=0.03). There were no differences in demographics, Injury Severity Score, operative transfusions, or estimated blood loss between the two groups. No differences in morbidity, including organ/space infection (HC 16% vs QI 12%, p=0.15), fascial dehiscence (6% vs 8%, p=0.20), acute renal failure (13% vs 13%, p=0.85), unplanned re-laparotomy (11% vs 10%, p=0.58), ileus (19% vs 23%, p=0.12), or mortality (9% vs 10%, p=0.69), were observed.



Conclusion: A QI project to openly share surgeon-specific rates, indications, and group-adjudicated appropriateness of DCL resulted in an immediate, significant, and sustained decrease in the rate of DCL, from 38% to 23%. This decrease was not associated with increased morbidity or mortality.

Poster # 7

FEVER TRENDS AND UTILITY OF EARLY BROAD SPECTRUM ANTIBIOTIC THERAPY IN PEDIATRIC SEVERE BURN PATIENTS

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Introduction: There is considerable debate about the clinical indications for initiation of broad spectrum antibiotic therapy in early treatment (first 48 - 72 hours) of severe burn patients. This study examines the early fever pattern in severe burn patients and the utility of early initiation of broad spectrum antibiotics in preventing late infectious complications.

Methods: Institutional IRB approval was obtained prior to the initiation of this study. A retrospective review (2009 - 2015) was performed of an institutional prospectively-maintained burn registry. Patients < 18 years of age admitted with total body surface area (TBSA) thermal injury greater than 15% were included. Exclusion criteria included age > 18 years, death within 72 hours of admission, and concomitant non-burn traumatic injuries. All parametric data were examined using Student's t-test and non-parametric data were analyzed using Chi-squared analysis. The initial fever pattern was examined and infectious outcomes were compared between patients receiving broad spectrum antibiotic therapy within the first 48 hours post-injury and those who did not receive early antibiotic therapy. Multivariate analysis was performed for all outcomes based on a priori hypotheses.

Results: Fifty two patients met inclusion criteria. Median age was 4 years (IQR 2 – 11.8 years), with 75% male. Median TBSA was 21.6% (IQR 16 – 32.8%). At 48 hours post injury, Tmax averaged 38.8 degrees Centigrade, and 81% of patients had Tmax greater than 38.0 degrees Centigrade. At 72 hours post injury, Tmax was 40 degrees Centigrade, and 88% of patients experienced fever > 38.0 degrees Centigrade. 25% of patients received broad spectrum antibiotic therapy within the first 48 hours after injury and 44% within 72 hours. Multivariate regression controlling for TBSA, body weight, and initial ED disposition (ICU versus floor bed) demonstrated no difference in late infectious outcomes, defined as those occurring later than 7 days post injury, between the patients who received antibiotic therapy in the first 48 or 72 hours and those who did not (OR 0.82, 95% CI 0.43 – 1.98 at 48 hours; OR 1.29, 95% CI 0.63 – 2.64 at 72 hours). Similarly, no difference was observed in rates of late wound infection, bloodstream infection, and urinary tract infection between the two groups. There was no significant difference in length of stay, number of ICU days, and number of ventilator days between the groups.

Conclusions: Nearly all patients with severe burns are febrile within the first 48 – 72 hours post injury. However, on multivariate analysis, initiation of broad spectrum antibiotic therapy did not result in reduction of infectious complications, reduced number of ICU days, reduced LOS, or reduced duration of mechanical ventilation. Given concerns regarding antimicrobial stewardship and breeding of resistant organisms, as well as the concern for adverse reactions associated with antibiotic therapy, the decision to start antibiotics in the first 48 – 72 hours after injury should be carefully considered even in the face of early fevers.

Poster # 8

ASSOCIATION OF EARLY RESUSCITATION WITH 5% ALBUMIN SOLUTION AND LATE INFECTIOUS COMPLICATIONS IN PEDIATRIC SEVERE BURN PATIENTS

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Introduction: Early resuscitation of severe burn patients is challenging due to the extreme capillary disturbance and leakage of intravascular fluid into the interstitial space. This has resulted in interest in the use of colloidal products including albumin and fresh frozen plasma as primary resuscitation products in severe burn patients. This study sought to determine whether early administration of 5% albumin in severe burn patients resulted in improved outcomes.

Methods: Institutional IRB approval was obtained prior to the initiation of this study. A retrospective review (2009 - 2015) was performed of a single-institution prospectively-maintained burn registry. Patients < 18 years of age admitted with total body surface area (TBSA) thermal injury greater than 15% were included. Exclusion criteria included age > 18 years, death within 72 hours of admission, and concomitant non-burn traumatic injuries. Outcomes were compared between patients receiving 5% albumin as part of resuscitation in either bolus or continuous administration within the first 48 hours post-injury and those who receiving only crystalloid. All parametric data were examined using Student's t-test and non-parametric data were analyzed using Chi-squared testing. Multivariate analysis adjusting for TBSA, patient weight, and ED disposition (ICU versus routine floor) based on a priori hypotheses was performed for all outcomes in question.

Results: Fifty two patients met inclusion criteria. Median age was 4 years (IQR 2 – 11.8 years), with 75% male. Median TBSA was 21.6% (IQR 16 – 32.8%). 23% of patients received 5% albumin in either bolus or continuous administration within the first 48 hours of injury, and 29% within 72 hours of injury. Multivariate regression controlling for TBSA, body weight, and initial ED disposition (ICU versus floor bed) demonstrated no difference in escharotomy requirement, unplanned intubation, duration of mechanical ventilation, number of ICU days, or length of stay between those patients who received albumin and those who did not. However, a statistically significant difference was observed in rates of late infection between the groups, with those receiving albumin at higher risk of developing late bloodstream, wound, or urinary tract infections (OR 5.41, 95% CI 1.15 – 25.6 at 48 hours; OR 5.76, 95% CI 1.35 – 24.7 at 72 hours).

Conclusions: The administration of 5% albumin is associated with higher risk of late infectious complications than crystalloid alone without a concomitant improvement in duration of mechanical ventilation, ICU days, length of stay, escharotomy requirement, or late intubation requirement. While limited by retrospective nature and number of patients, this study does not support the use of 5% albumin as a resuscitative fluid in pediatric severe burn patients.

Poster # 9

THE IMPACT OF BURN SIZE AND OTHER FACTORS ON WOUND HEALING RATE

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Introduction: The ability to accurately track the progress of burn injuries is vital for effective burn management and to improve patient outcomes. In order to increase the accuracy of burn wound mappings, we developed a computer-based burn mapping program to document full- and partial-thickness burns and ongoing surgical treatment modalities. The goal of the present study was to characterize the impact of burn size and other factors on wound healing rates.

Methods: A retrospective analysis of data from patients admitted to our burn center between August 2009 and March 2015 was conducted. All adult (≥18 years old) patients with a burn size of at least 20% TBSA and at least three computer-based wound mappings were included in the analysis. The data from the mappings was used to calculate average healing rates.

Results: Data from 130 eligible patients was identified and analyzed. Median length of stay was 34.5 days (20 ICU days) and overall mortality was 31.5%. The number of available computer-based wound mappings per patient varied (range: 3-45, median: 7), in part because the burn size varied widely (range: 20-99 %TBSA, median: 32 %TBSA). Survivors healed (median 0.9 %TBSA/day) and non-survivors did not (median 0.0 %TBSA/day). Large burns (≥30 %TBSA) healed significantly slower (0.3±0.1 %TBSA/day) than smaller burns (0.9±0.2 %TBSA/day), and elderly patients (> 65 years old) healed significantly more slowly (0.2 %TBSA/day) than younger patients (18-39 years old, 0.9 %TBSA/day).

Conclusion: Here we provide, for the first time, quantifiable data to support the anecdotal concept that large burns heal more slowly than small burns as average wound healing rates were inversely correlated with burn size. Average healing rates were also inversely correlated with age. Further analysis of the existing dataset will evaluate the impact of treatments, burn location, and other factors on healing rates.

Poster # 10

MORTALITY, FASCIAL CLOSURE, AND THE INFLAMMATORY CASCADE: A PROSPECTIVE RANDOMIZED TRIAL COMPARING NEGATIVE PRESSURE WOUND THERAPY AND BARKER'S VACUUM PACK TECHNIQUE FOR ABBREVIATED TRAUMA LAPAROTOMY

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Introduction: Two recent studies (WJS 2013 and Ann Surg 2014) involving mixed cohorts of septic and trauma abbreviated laparotomy (AL) patients have reported higher fascial closure and lower mortality rates with ABThera TM negative pressure therapy system (NPT) vs Barker's vacuum-pack technique (BPT). Improved outcomes with NPT have been attributed to higher elimination of pro-inflammatory cytokines from peritoneal fluid. We pursued these questions further, eliminating potential confounders associated with a septic cohort by conducting this prospective randomized trial exclusively in trauma patients.

Methods: 40 trauma patients requiring AL were cluster randomized by on-call surgeon to NPT (n=20) or BPT (n=20). Primary outcomes were fascial closure and mortality rates. Secondary outcomes included MODS scores, incidence of infection, ventilator days, and volume of peritoneal fluid removed. Concentrations of 17 cytokines in peritoneal fluid and serum were determined.

Results: No significant differences between NPT and BPT were found with respect to age, gender, mechanism of injury, injury severity, or admission base deficit. There were no differences in mortality or fascial closure rates (p=0.99). NPT removed a larger volume of fluid (p=0.03) and resulted in lower levels of TNFα (p=0.006) and IL-1β (p=0.008) in the peritoneal fluid at 24 hours. Higher serum IL-6 was associated with penetrating trauma (p=0.004), intraabdominal abscess formation (p=0.03), and lower rates of fascial closure (p=0.03).

Conclusion: In this group of severely injured trauma patients, we observed no differences in mortality or fascial closure rates between the treatment groups; NPT and BPT were similarly efficacious in the management of the open abdomen. In the absence of differences in mortality or closure rates, the clinical significance of peritoneal fluid and cytokine clearance remains elusive. Measurement of baseline serum IL-6 in penetrating trauma patients may identify those most likely to develop intraabdominal abscesses and those who will go on to require staged abdominal wall reconstruction.

Poster # 11

IDARUCIZUMAB FOR REVERSAL OF THE ANTICOAGULANT EFFECTS OF DABIGATRAN IN THE TRAUMA SETTING: RE-VERSE AD INTERIM RESULTS

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Introduction: Idarucizumab, a recently approved humanized monoclonal antibody Fab fragment, specifically reverses dabigatran's anticoagulant effect. Here, we report an interim analysis of the subset of trauma patients with severe bleeding or requiring urgent surgery in the ongoing RE-VERSE AD study.

Methods: RE-VERSE AD is a, multinational, single cohort study investigating the safety and efficacy of 5g idarucizumab to reverse dabigatran in patients with life-threatening or uncontrolled bleeding or who require an emergency procedure with a need for hemostasis. Study endpoints include the maximum reversal of the anticoagulant effect of dabigatran in the first 4 hours (primary endpoint), based on diluted thrombin time (dTT) or ecarin clotting time (ECT), and assessments of clinical outcomes.

Results: All 18 trauma patients (10 with severe bleeding and 8 others requiring urgent surgery, age range 59-92 y) received 5g idarucizumab based on the treating clinician's impression that reversal was warranted; median time from last dabigatran dose to treatment was 16.1 hr. The injuries were 8 fractures (3 femoral neck, 2 femur, 1 hip-not specified, 1 ankle, 1 wrist) all requiring emergency surgery, 6 intracranial hemorrhages (4 subdural, 3 subarachnoid, 1 intracerebral), and 4 blunt traumas leading to major soft tissue bleeding (1 retroperitoneal, 2 intramuscular, 1 polytrauma). Median maximum percent reversal of anticoagulation was 100% (95% CI, 100–100) over 4 hours as assessed by dTT and ECT. Dabigatran plasma levels were below limit of quantification (BLQ) in all trauma patients at the end of second infusion and stayed BLQ for ≥12 hours. In the 8 patients undergoing surgery as the index inclusion criteria, intraoperative hemostasis was normal in 7 patients and mildly abnormal in 1 patient; median time to surgery was 3.9 hours (range: 0–23). Of the 10 cases with bleeding related to trauma, bleeding stopped in 5 patients; cessation of bleeding was not assessable in 4 patients and the information was missing for 1 patient. Four of these 10 patients proceeded into surgery/invasive procedures to further address the bleeding. One patient had deep vein thrombosis/pulmonary embolism 9 days post-idarucizumab, while not receiving anticoagulation. Median duration of hospitalization for all 18 patients was 15.5 days (range: 4–93); all survived to hospital discharge.

Conclusion: These preliminary results suggest that idarucizumab rapidly, completely and durably reverses dabigatran and facilitates the management of dabigatran-treated patients who present after serious trauma.

Poster # 12

IMPACT OF IMPLEMENTING AN ACUTE CARE SURGERY SERVICE ON OPERATING ROOM EFFICIENCY

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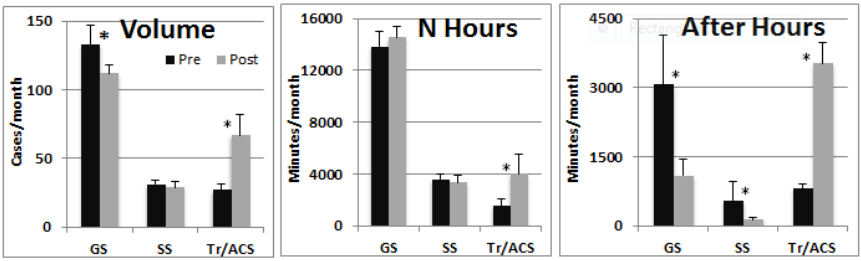
Introduction: The operating room (OR) is a resource intensive and high cost center within the hospital. The ready availability of a staffed OR and surgeon are essential for the effective functioning of an Acute Care Surgery (ACS) model of care. No study has evaluated the impact of adopting the ACS model on the efficiency of the OR. The current study tests the following hypothesis: adopting an ACS care delivery model will lead to 1. increased OR efficiency and 2. cost savings.

Methods: OR utilization metrics – case volume, group utilization, after-hours utilization, proportion of operative time in normal working hours – were obtained from the OR management database [WiseOR® (Palo Alto, CA)] 12 months before (Pre: Oct 2014-Sept 2015), and 5 months after (Post: Oct 2015-Feb 2016) ACS model implementation. Service utilization times for the services providing acute surgical care in the Pre period were compared to the ACS service in the Post period. All data was entered into Microsoft Excel (Redmond, WA) and analysis performed with Stata 13.1 (StataCorp LP, College Station, TX). Significant was set at $p < 0.05$.

Results: Pre ACS implementation, Trauma, General surgery (GS) and specialty surgery (SS) services provided care for the acute surgical patient (Trauma and Emergency General Surgery). Post implementation the integrated ACS service was the sole provider of such care.



Post ACS implemtation the volume of cases were higher for Tr/ACS and lower for GS ($p<0.05$ for both). Post implentation OR utilization in normal working hours increased for all services ($p<0.05$ for all) while after hours utilization decreased for GS and SS ($p<0.05$) and increased for Tr/ACS ($p<05$) - Figure. OR utilization efficiency (measured as proportion of total utilized time that was during normal business hours) improved for GS and SS from 83% to 93% ($p<0.05$).

Conclusion: Implementation of an integrated ACS service with ready availability of OR and surgeon leads to improved OR efficiency. By shifting OR utilization from the more expensive and variable cost after hours to fixed cost normal hours, significant cost saving are achieved.

Poster # 13

OUTCOMES OF COMPLICATED APPENDICITIS: IS CONSERVATIVE MANAGEMENT AS SMOOTH AS IT SEEMS?

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Introduction: Management of complicated appendicitis (perforation with abscess or phlegmon) remains controversial. Cases are often initially managed conservatively with antibiotics and percutaneous drainage of abscesses to decrease surgical morbidity of open operations and formal bowel resections associated with perforation. Some experts recommend interval appendectomy (IA) because it is curative and there is an increased association of malignancy seen in patients presenting with perforation. However, it is not clear that IA actually decreases surgical morbidity seen in patients managed operatively during initial admission for complicated appendicitis.

Methods: This is a single institution retrospective cohort study from January 1, 2007 through June 1, 2014 of patients diagnosed with acute appendicitis. Patients with complicated appendicitis based on imaging were grouped into immediate and interval management cohorts and surgical outcomes were analyzed. Multivariate logistic and linear regression models were developed to compare adjusted patient outcomes between study groups.

Results: During the study period 582 patients were diagnosed with appendicitis. Of these, 87 patients with complicated appendicitis underwent surgery and outcomes between immediate (n=64) versus interval groups (n=23) were compared. Similar rates of open appendectomies were found within each group with 34.4% in the immediate group and 30.4% in the interval group. Conversion rates were found to be higher in the immediate group, 23.8% versus 13.3%. However, 9 patients initially managed in an interval manner failed requiring early surgical intervention. Of this failure group, 5 required formal bowel resections compared to only one patient that required a formal bowel resection in the immediate group. Patients managed in an interval fashion on average required 3.48 office visits, 2.92 CT scans, and 19.2 days of antibiotics prior to definitive surgery.

Conclusion: Most studies finding increased surgical morbidity of complicated appendicitis managed operatively are compared to simple appendicitis. To our knowledge, this is the first study comparing complicated appendicitis managed during index admission to interval appendectomy. Overall, patients managed in an interval manner did not have decreased surgical morbidity and in fact had a higher incidence of formal bowel resections. As well, patients managed with IA had increased length of antibiotics, office visits and number of CT scans prior to surgery. Larger prospective studies are needed to further define which patients should be managed conservatively.

Poster # 14

LAPAROSCOPIC COMMON BILE DUCT EXPLORATION AND ACUTE CARE SURGERY: LIMITED EXPOSURE IN TEACHING HOSPITALS

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Introduction: Management of choledocholithiasis (CDCL) requires expertise in minimally invasive procedures like laparoscopic common bile duct exploration (LCBDE) or endoscopic retrograde cholangiopancreatography (ERCP). Both are technically challenging and their use depends on specialty availability and level of training received. Data is lacking on nationwide rates for treatment of CDCL based on location and teaching status, particularly in the acute care setting. We describe nationwide utilization of ERCP and LCBDE for CDCL presenting to the emergency department (ED), with sub-analysis of hospital teaching status and location.

Methods: The National Inpatient Sample (NIS) database was queried for all emergency admissions with a diagnosis of CDCL requiring laparoscopic cholecystectomy (LC) during the same hospital admission. Patients were included if they underwent either a LCBDE or ERCP. Hospital data was analyzed from 2010-2012. Our outcome measures included rates of ERCP and LCBDE based on teaching status, location (urban vs. rural), length of stay (LOS) and cost.

Results: A total of 12,691 patients with CDCL were identified, with the minority undergoing LCBDE (2.7%, n=272) vs. ERCP only. Both groups were similar in age, gender, race, and payer type. The LCBDE group had significantly shorter LOS (4.7 vs. 5.5 days, $p=0.002$) and lower total charges ($41,489 vs. $55,371, $p<0.001$) when compared to the ERCP group. Overall, LCBDEs were performed twice as much in non-teaching hospitals vs. teaching hospitals (1.8% vs. 0.9%, $p= 0.03$), however the procedure of choice for CDCL was ERCP (97.3% of cases). Urban hospitals performed the majority of LCBDEs (73.1% urban vs. 26.9% rural). Urban teaching facilities performed LCBDEs at lower rates compared to their non-teaching counterparts (2.2% vs. 3.1%, $p=0.038$).

Conclusion: LCBDE was associated with reduced LOS and cost compared to ERCP. LCBDE is less commonly performed in teaching hospitals, and the least frequently in rural settings suggesting potential limitations on training.

Poster # 15

APPENDICEAL MALIGNANCY PRESENTING IN PATIENTS WITH ACUTE APPENDICITIS: NOT A DISEASE OF THE ELDERLY

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Introduction Patients with a primary appendiceal malignancy (AM) often present with variable symptoms, including those of acute appendicitis (AA). Recent studies have demonstrated efficacy for treating patients with uncomplicated AA with antibiotics alone. However, with the incidence of AM increasing nearly two-fold over the past ten years, it is vital to identify characteristics of patients who present with AA, but ultimately have a primary AM. The purpose of this study is to identify characteristics and outcomes of patients diagnosed with a primary AM after treatment for AA.

Methods A retrospective review of a pathology database was performed identifying all patients who presented with AA and underwent surgical management between January 2000 and December 2010. Pathology reports were reviewed and patients with primary AM were identified.

Results Of the 2676 patients surgically treated for AA, 0.8% (n=24) had a primary AM. Patients with a primary AM had a mean age of 42±18.9 years. Patients were more likely to be Caucasian (84%, n=20) than African American (8%, n=2) or Hispanic (8%, n=2) and presented with an average white blood cell count of 11.2±4.0. Patients were more likely to have a carcinoid tumor (42%, n=10) or mucinous neoplasm (42%, n=10), followed by an adenocarcinoma (16%, n=4). A majority of patients required no further intervention after initial operation (80%, n=19). Only 20% (n=5) underwent subsequent right hemicolectomy, two of which were definitive. The remaining patients underwent chemotherapy (4%, n=2) or transitioned to palliative care (2%, n=1).

Conclusions Our data suggest that AM is not a disease exclusive to the elderly and shows that patients diagnosed with a primary AM after treatment for AA are between the ages of 17 and 60, Caucasian, present with a white blood cell count just above normal, and generally have an appendiceal carcinoid or mucinous neoplasm. Most patients were appropriately treated with their primary procedure, with a minority of patients requiring further surgical intervention or adjunct treatments, including chemotherapy or palliation. These findings suggest that acute care surgeons must be aware that every appendectomy is potentially an oncologic procedure.

Poster # 16

VALIDATION OF THE AMERICAN COLLEGE OF SURGEONS NSQIP SURGICAL RISK CALCULATOR IN EMERGENCY GENERAL SURGERY PATIENTS

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Introduction: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Surgical Risk Calculator is a tool designed to estimate the chance of an unfavorable outcome after surgery. Although it is widely used, it still requires validation for individual patient populations. Our goal was to evaluate the accuracy of the risk calculator in our emergency general surgery (EGS) population.

Methods: Data were collected from our institutional NSQIP database from patients undergoing EGS procedures at a tertiary referral center over a 12-month period. The CPT code and patient risk factors were placed into the risk calculator and a predicted risk of complications was obtained. This was then compared to actual outcomes. For each patient, risk was calculated with adjustments 1-3 available within the calculator (1-no adjustment necessary, 2 -risk somewhat higher than estimate, 3-risk significantly higher than estimate). A p value of <0.05 was used to define statistical significance.

Results: From April 2014 to March 2015, 227 patients met inclusion criteria. Actual outcomes are compared to predicted outcomes using adjustments 1-3 (see Table 1 and 2). For all categories examined, the predicted risk with an adjustment of 1 was similar to the actual complication rate. In multiple categories a risk adjustment of 2 or 3 resulted in a predicted risk that was statistically significantly higher than actual patient outcomes.

Complication	Predicted ± SD	Actual	p value
Mortality		7.9%	
Adjustment 1	5.7 ±10.8%		0.17
Adjustment 2	8.5 ±11.8%		0.75
Adjustment 3	14.8 ±39.2%		0.0016
Return to OR		12.3%	
Adjustment 1	7.1 ±7.6%		0.82
Adjustment 2	8.4 ±8.9%		0.61
Adjustment 3	10.7 ±11.0%		0.10
Discharge to nursing home		12.3%	
Adjustment 1	14.8 ±24.3%		0.28
Adjustment 2	22.2 ±25.6%		0.0001
Adjustment 3	30.4 ±30.6%		<0.0001

Table 1: Mean predicted risk with standard deviation vs. actual risk for major complications

Complication	Predicted ± SD	Actual	p value
Pneumonia		3.5%	
Adjustment 1	3.4 ±4.8%		0.91
Adjustment 2	4.6 ±5.7%		0.0025
Adjustment 3	6.7 ±7.9%		<0.0001
Cardiac Complications			
Adjustment 1	2.0 ±3.0%	3.1%	0.28
Adjustment 2	2.9 ±3.5%		0.87
Adjustment 3	4.5 ±5.1%		0.27
Surgical Site Infection		6.6%	
Adjustment 1	5.4 ±5.5%		0.43
Adjustment 2	7.5 ±7.2%		0.60
Adjustment 3	9.7 ±9.1%		0.09

Table 2: Mean predicted risk with standard deviation vs. actual risk for individual complications

Conclusion: The ACS NSQIP Surgical Risk Calculator is valid in the EGS population. A risk adjustment of 1 was predictive of actual patient outcomes while risk adjustment of 2 or 3 frequently led to significant over-estimation of potential complication rates. These data support the use of this tool in the EGS population in patient care decisions as well as to inform conversations with patients and families about outcome expectations.

Poster # 17

VALIDATION OF AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA (AAST) GRADING SYSTEM TO MEASURE ANATOMIC DISEASE SEVERITY IN EMERGENCY SURGERY FOR ACUTE CHOLECYSTITIS

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Introduction: A uniform grading system for measuring anatomic severity of emergency general surgical diseases was developed by the AAST in an effort to achieve standardization for quality assurance, outcomes research and surgical training. To date, this grading system has not been validated and thus correlation of outcomes with anatomic severity is unknown. The aim of our study was to compare the morbidity and mortality of patients undergoing emergent laparoscopic cholecystectomy with disease severity as proposed by the AAST.

Methods: A retrospective review was conducted of all patients who underwent emergent laparoscopic cholecystectomy after presenting to the emergency department with acute cholecystitis from 2005-2015. Disease severity was categorized based on AAST grading scale (I-V) (Figure 1). Statistical comparisons were made between increase in severity within groups and worsening postoperative complications.

Results: A total of 237 patients, mean age 64.8 ± 17.5 years, underwent emergency laparoscopic cholecystectomy during the study period. The majority were males (n=134, 56.5%, white (n=214, 90.3%) and had previous abdominal surgery (n=122, 51.5%). The most common comorbidity included obesity (n=72, 30.4%), coronary artery disease (n=44, 18.6%) and diabetes (n=40, 16.9%). A total of 28 patients (11.8%) were converted to open and 70 (29.5%) had postoperative complications. Patients in each grading category of AAST were as follows: Grade I (n=196, 82.7%), Grade II (n=37, 15.6%), Grade III (n=3, 1.3%), Grade IV (n=1, 0.4%), Grade V (n=0, 0%). Patients with increasing grade were more likely to present with septic shock (p=0.002), develop postoperative complication (p=0.035) and have increased length of stay (p=0.010). There was no association with iatrogenic biliary injury (p=0.143), reoperations (p=0.955) and 30 day mortality (p=0.860).

Conclusion: Using the AAST grading system, increasing disease severity predicts postoperative complications but not mortality in this series. The paucity of patients in Grade III-V may necessitate re-alignment of the anatomic descriptions to form a more reproducible predictive model.

Poster # 18

LAPAROSCOPIC FENESTRATING SUBTOTAL CHOLECYSTECTOMY: A SAFE APPROACH TO THE DIFFICULT GALLBLADDER.

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Introduction: Biliary system injury at the time of laparoscopic cholecystectomy (LC) is known to occur when operative intervention is complicated by severe local inflammation. To mitigate such risks, partial cholecystectomy has long been described as an acceptable open approach and has been applied as a viable laparoscopic technique. Different management options for the portion of the gallbladder that is left in situ, most notably fenestrating versus reconstituting subtypes, have recently been defined. Individual subtype results, however, remain unclear. We describe the experience of an acute care surgery service at a tertiary referral center with numerous successful applications of laparoscopic fenestrating subtotal cholecystectomy (LFSC) when a critical view of safety could not be obtained.

Methods: During a thirty month period during 2013-2016, our mixed acute care surgery and trauma service operatively managed patients with acute gallbladder pathology, primary with a laparoscopic modality. Of these patients, several were treated with a LFSC technique including removal of the peritoneal portion of the gallbladder and expressed stones, as well as placement of a closed-suction drain. We observed for duration of drain requirements, persistence of biliary fistula, further operative or endoscopic intervention requirements, as well as open conversion rates. Length of stay (LOS) was also compared between LC, LFSC, and open conversion.

Results: Of 155 patients who were operatively managed after non-elective consultation, 17 patients underwent LFSC. Additionally, 4 patients required open conversion (2.5%). Of the 17 patients managed with LFSC, the median age was 42 (range 21-66) with 9 males and 8 females. The operative diagnosis of the LFSC patients was acute cholecystitis for 11 patients, gangrenous cholecystitis for 4 patients, and chronic cholecystitis for 2 patients. LOS following LFSC was a median of 3 days (range 2-5) as compared to LOS of 1 day (range 0-10) for LC and 6 days (range 2-7) for open conversion. Post-operative requirement for ERCP was noted in 2 patients for high biliary output. The duration of closed-suction drain requirements for LFSC was a median of 18 days (range of 13-40.) There were no extra-cystic biliary injuries for any patient noted.

Conclusion: When a critical view of safety is not able to be obtained, our experience shows that a fenestrated technique for subtotal cholecystectomy is a viable option for difficult gallbladders and may be considered as an alternative to open conversion.

Poster # 19

PROLONGED PREOPERATIVE LENGTH OF STAY IS ASSOCIATED WITH PROLONGED POSTOPERATIVE LENGTH OF STAY IN CHOLECYSTECTOMY FOR ACUTE CHOLECYSTITIS

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Introduction: In the past two decades there has been considerable research assessing optimal timing of cholecystectomy in acute cholecystitis (AC) to reduce intraoperative complications. Few studies have assessed the impact of delayed operative management on overall length of hospital stay. We hypothesized that prolonged preoperative length of stay (preLOS) would be associated with prolonged postoperative length of stay (postLOS) in patients with AC undergoing laparoscopic cholecystectomy (LC) in the absence of other complicating factors. Secondary outcomes included rate of LC to open cholecystectomy (OC) conversion, discharge to continued care facility, 30-day readmission, and the association between preLOS and day of the week admission.

Methods: We reviewed 715 consecutive patients who underwent cholecystectomy. To capture patients who were primarily admitted and treated for AC, we excluded patients with additional final hospital diagnoses and those who underwent additional preoperative or postoperative procedures. Patients who underwent planned OC were also excluded. GraphPad software was used for statistical analysis ($p<0.05$ considered significant).

Results: 394 of 715 patients had both a diagnosis of AC and underwent only cholecystectomy. 374 underwent LC alone.

	Preoperative Length of Stay (days)		
	1-2	3-4	>4
LC to OC Conversion	3.6%	7.5%	21.1%
PostLOS (days)*	1.34	1.88	2.72
Discharge to Facility*	2.0%	9.7%	40.0%
30-day Readmission*	4.4%	9.7%	14.3%

p<0.01 for all rows, *LC patients only

In LC alone, procedure duration average was 74.7 minutes and did not vary significantly by preLOS ($p=0.89$). Average preLOS was 1.19 days vs 1.71 days for Monday and Tuesday admission vs. Friday, Saturday, and Sunday ($p<0.01$).

Conclusion: Prolonged preoperative length of hospital stay in patients undergoing laparoscopic cholecystectomy for acute cholecystitis is associated with prolonged postoperative length of stay, increased rate of conversion to open, transfer to a continued care facility, and 30-day readmission. Weekend admission is associated with a longer preoperative time compared to early week admission.

Poster # 20

TRANSFER STATUS: A SIGNIFICANT RISK FACTOR FOR MORTALITY IN PATIENTS REQUIRING EMERGENT COLON SURGERY

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Introduction: Patients with time-sensitive surgical diagnoses benefit from early surgical source control. Since transfer from outside facilities can delay definitive treatment, we investigated the influence of transfer status on the postoperative mortality in patients requiring emergent colon surgery.

Methods: Emergent open and laparoscopic colon resections were identified in the American College of Surgeons National Surgical Quality Improvement Program datasets for 2010 to 2012. Four groups were identified by location and timeliness of transfer: home, outside emergency department (ED), outside hospital ward, or nursing home / chronic care facility. Thirty-day survival was analyzed by Kaplan-Meier method, including multivariable Cox regression analyses.

Results: A total of 13,967 patients were identified. Thirty-day mortality varied significantly ($p<0.0001$) among the four groups; increasing timeliness of transfer had increasing probabilities of survival ($p<0.0001$). Hazard ratios indicated that, compared to patients presenting from home, the relative risk of death after transfer from outside ED was 1.38 ($p<0.0001$), after transfer from outside hospital ward was 1.54 ($p<0.0001$), and after transfer from nursing home or chronic care facility was 2.15 ($p<0.0001$). Patients transferred from a nursing home or chronic care facility were more likely to have septic shock ($p<0.0001$) or an American Society of Anesthesiology (ASA) Score of 4 ($p<0.0001$) or 5 ($p<0.0001$).

Conclusion: Transfer status is an independent contributor to death in emergency general surgery patients undergoing colon resection. Those patients emergently taken to the operating room after transfer from a nursing home or chronic care facility have the poorest outcomes, partially due to increased physiologic decompensation and poorer physical status. These results reinforce the importance of timely surgical evaluation and intervention, and suggest a potential role for more rapid transfer and improved triage in patients requiring emergency surgery.

Poster # 21

FAILURE TO RESCUE: DISPARITIES INFLUENCE OUTCOMES IN PATIENTS WITH NECROTIZING SOFT TISSUE INFECTIONS

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Introduction: Necrotizing soft tissue infection (NSTI) is a rare but morbid and potentially life-threatening disease. Because of the progressive nature of NSTI, patients often require referral to tertiary care centers for definitive treatment. Racial, socioeconomic, and gender disparities in healthcare and outcomes for septic patients are well known. The objective of this study was to evaluate the impact of hospital characteristics on mortality disparities among patients with NSTI.

Methods: Patients 18-65 years old hospitalized with NSTI, defined by the ICD-9 codes for necrotizing fasciitis, gas gangrene or Fournier's gangrene were identified in the Nationwide Inpatient Sample Database from 1996-2012. Patient factors studied included demographics, insurance, shock, and Charlson comorbidity index (CCI). Other factors studied included inter-facility transfers, weekend admissions and teaching hospital status. Univariate, bivariate and multivariate logistic regressions were performed to characterize the influence of Teaching (TH) and non-Teaching hospitals (nTH) on disparities in mortality for patients with NSTI.

Results: There were 31,072 patients with NSTI identified. The mean age was 45 years and 32% were female. TH accounted for 54.3% of all admissions. TH vs nTH patient populations were significantly different in racial distribution, insurance types, as well as the proportion of patients with shock (16% vs 13%, $p<0.001$). Inter-facility transfers occurred in 11.5% of admissions, with significantly more transfers into TH 69% ($p<0.001$). TH also had more inter-facility transfers on the weekend compared to nTH (22% vs 13%, $p<0.001$).

Overall mortality was 9.5%. Mortality was higher at TH than nTH (11% vs 8%, $p<0.001$). Independent predictors of death included female gender, Hispanic race, higher CCI and having Medicare or Medicaid as insurance (OR 1.3 $p<0.001$, OR 1.1 $p=0.038$, OR 2.2 $p<0.001$ & OR 1.6 $p<0.001$ respectively). Additionally, inter-facility transfers, weekend admissions and TH had a higher risk of death (OR 1.3 $p<0.001$, OR 1.1 $p=0.017$ & OR 1.4 $p<0.001$ respectively).

The highest risk of death was associated with shock (OR 4.7 $p<0.001$). Patients in shock were more likely to be transferred, and more likely to be transferred to a TH (OR 1.4, $p=0.003$), be admitted on the weekend (OR 1.3, $p=0.033$), and be uninsured (OR 1.5, $p=0.014$). On subgroup analysis, patients in shock had an increased risk of death at both TH and nTH, though this risk was less pronounced at THs (OR 4.2 vs. OR 5.5, $p<0.001$).

Conclusion: Disparities exist in the inter-facility transfer patterns of teaching and non-teaching hospitals that influence outcomes for patients with NSTI. Insurance status may influence timely access to optimal care resulting in failure to rescue patients.

Poster # 22

SAFETY OF EARLY TRACHESOTOMY IN TRAUMA PATIENTS AFTER ANTERIOR CERVICAL FUSION

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Introduction: Cervical spine injuries (CSI) have major effects on the respiratory system and carry high incidence of pulmonary complications. Early tracheostomy and ventilator support are often indicated in patients with CSI. However, in patients with anterior cervical fusion (ACF) concerns about cross contamination often delay tracheostomy placement. This study aims to demonstrate the safety of early tracheostomy within four days of ACF.

Methods: Retrospective chart review was performed of all trauma patients admitted to our institution between 2001-2015 with diagnosis of CSI who required both ACF +/-posterior cervical fusion (PCF) and tracheostomy during the same hospitalization. 39 study patients with early tracheostomy (1-4 days after ACF) were compared to 59 control patients with late tracheostomy (5-21 days after ACF). There was no difference in age, sex, preexisting conditions, trauma and CSI severity scores between both groups. Univariate and logistic regression analyses were performed to compare risk of pneumonia, wound infection and sepsis between both groups during the hospital stay.

Results: There was no difference in pneumonia, wound infection and sepsis between both groups: among the 39 patients with early tracheostomy, 14 had pneumonia (36%) compared to 20 of the 59 patients (34%) with late tracheostomy (p=0.84, Chi Square). Two of the 39 early tracheostomy patients (5%) had sepsis compared to 10 of the 59 (17%) late tracheostomy patients (p=0.12). There were no cases of cervical fusion wound infection in the early tracheostomy group (0%), but 5 cases (8.47%) in the late tracheostomy group (p=0.15), four of which involved the PCF wound and one ACF wound. There was no difference in ICU stay (p=0.2), hospital stay (p=0.23) and mortality (p=0.06) between groups.

Conclusion: Early tracheostomy within 1-4 days after ACF is safe without increased risk of infection compared to later tracheostomy.

Poster # 23

ACUTE CARE SURGERY: TRAUMA, CRITICAL CARE, EGS.....AND PREVENTATIVE HEALTH?

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Introduction: Acute care surgeons routinely care for a unique set of patients who may have limited access to the healthcare system outside of emergency encounters. These patients may not participate in typical preventative screenings/interventions (PSI's) such as mammography (MO), colonoscopy (CO), or pneumococcal vaccinations (VA). We sought to investigate the compliance rate with nationally established PSI's at our urban Level I trauma center, identify any related barriers, and determine if acute care surgeons have an opportunity to facilitate improved compliance in this patient population.

Methods: Over a six month period, all patients evaluated by the acute care surgery service were prospectively enrolled after informed consent. A single patient could be enrolled into each arm (MO, CO, VA) based on PSI recommendations. Patients were screened to assess their compliance and identify barriers to participation. Screening parameters included variables such as: insurance status, highest level of education, primary language, and primary care physician status. For those patients who were not in compliance with PSI recommendations, we developed a PSI bundle (PSIB) to be administered after completion of the screening. The PSIB included an educational component, followed by an interventional component. The intervention consisted of same stay administration of the pneumococcal vaccine, and scheduling of indicated MO and CO regardless of insurance status. Final compliance was assessed with a follow-up phone call.

Results: During the study period, 90 patients were enrolled into each study arm. Individually, the initial compliance rate for MO, CO, and VA were 63%, 58%, and 67% respectively. Patients without a primary care physician had a compliance rate of 32%. The most commonly cited reason for non-compliance was lack of knowledge of the PSI recommendations (41%). Cost was not a significant barrier (16%). Males were twice as likely to be noncompliant when compared to females. Post PSIB scheduling compliance for MO was 85%, for CO 80%, and 100% of patients received their VA during the index admission. Final (actual) compliance at follow-up for MO was 72%, for CO 68%, and 100% for VA.

Conclusion: At our urban Level I trauma center, acute care surgeons evaluate a large number of general surgery and trauma patients. These patients frequently only access the healthcare system for emergencies, do not have primary care physicians, and are non-compliant with or unaware of national PSI recommendations. The acute care surgeon-patient interaction represents a valuable opportunity for education and improved PSI compliance. Our PSIB resulted in improved PSI compliance in all 3 categories. Additional research should focus on developing effective interventional strategies and evaluating their impact on patient outcomes.

Poster # 24

THE DEAD BOWEL CONSULT: WHAT DOES THE LACTATE LEVEL TELL US?

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Introduction: Accurate identification of patients with bowel ischemia remains a challenge. Previous studies have confirmed the limited value of serum lactate in securing the diagnosis, but have not fully assessed the potential value in lactate trends. The purpose of this study was to identify predictive laboratory findings for ischemic bowel. Since ischemic bowel (IB) likely serves as a site of ongoing lactic acid production, it was hypothesized that a falling lactate level would be rare in the presence of bowel ischemia

Methods: Billing records in a single large urban hospital were used to retrospectively identify patients with ICD codes for mesenteric ischemia, including patients with proven mechanical and non-mechanical gut ischemia, and patients who received surgical consultation for concern of ischemia. History, clinical exam, and imaging findings were documented. Serum lactate, pH, WBC, and base deficit were recorded for 24 hours before and after the time of consultation. Mean and peak serum lactate levels were recorded, and lactate levels were dichotomized to down-trending vs. stable/rising prior to any surgical intervention. Two-sample t-tests or non-parametric rank tests were used to test the differences in the laboratory measurements between patients who were confirmed to have IB and those who did not have IB. A p-value <0.05 was considered statistically significant.

Results: 165 patients met inclusion criteria. 62% had dead bowel confirmed at laparotomy, on surgical pathology, or at autopsy. Mean age was 64.3 years. 43% were male and 57% were female. 20% had dead bowel from a mechanical cause such as bowel obstruction or volvulus. There were no differences between mean (4.6±4.0 vs. 4.1±3.3 mmol/L) or peak (6.7±5.7 vs. 6.2±5.2 mmol/L) lactate levels between patients who did and did not have IB. 80% of patients with IB had stable/rising lactate levels, compared to 59% of patients without IB (p=0.0082). Patients with ischemic bowel were more likely have a lower mean pH (7.31 vs 7.36, p=0.003), minimum pH (7.21 vs 7.27, p=0.013), and mean base deficit (-6.81±4.76 vs -4.87±5.63, p=0.03) than those without. There were no significant differences in mean or maximum white blood cell count between the groups.

Conclusion: While it is somewhat uncommon for lactate levels to fall in the presence of ongoing bowel ischemia, 20% of patients with IB had downtrending lactic acid levels. Clinicians concerned about bowel ischemia should not be reassured by falling lactate levels.

Poster # 25

Higher Body Mass Index (BMI) and Low-Volume Surgeons Confer an Increased Risk of Operative Complications in Anterior Spinal Exposures

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Introduction: Anterior spinal exposures performed by spine or vascular surgeons have a known complication rate of 2-11%. We present the largest single institution experience of anterior spinal exposures performed by acute care surgeons. The goal of this study was to identify factors contributing to operative complications during the exposure. We hypothesized that low-volume surgeons and patients with a BMI >30 would have an increased complication rate.

Methods: All consecutive patients who underwent an anterior spinal exposure (thoracic or lumbar) by one of our six acute care surgeons over a five-year period were included in this study. Demographics including indication for surgery, history of previous spinal surgery, age, gender and BMI were collected. Operative reports were reviewed for all intraoperative complications. Outcomes including return to OR, hospital and intensive care unit length of stay (LOS), 30-day mortality and re-admission were recorded. Outcomes were analyzed using a Student's t-test with $\alpha = 0.05$ in GraphPad Prism version 5.00 (GraphPad Software, San Diego CA).

Results: In total 1170 patients underwent an anterior spinal exposure during the study period. Average BMI for the study population was 29.0 + 6.3.Three of the surgeons each performed at least 45 exposures per year and had individual experiences of 250 or more cases. The remaining three surgeons had performed less than 20 cases each over the five-year study period.
There were fifty-four major complications recorded: 41 vascular injuries, 10 returns to the operating room for bleeding and 3 visceral injuries including two ureteral injuries and one lung laceration.
Patients who experienced vascular complications tended to have a higher BMI (31.2 + 7 versus 28.9 +6.3, p=0.02). Low-volume surgeons had a higher rate of operative complications than high-volume surgeons (21.6% + 4.8% versus 8.7% + 3.8%, p=0.04). Age, gender, indication for procedure and previous history of spinal surgery did not confer a greater risk of operative complications according to our findings.

Conclusions: In this, the largest single institution experience of anterior spinal exposures performed entirely by acute care surgeons we demonstrate an overall complication rate of 3.5%, comparable to the published rate by spine or vascular surgeons. Obesity (BMI >30) appears to confer a slightly higher risk for vascular injury. The overall risk of all operative complications increases when the exposure is performed by less experienced surgeons. We recommend exposures be performed by a dedicated cadre of experienced acute care surgeons. Further study is required to determine the minimum number of mentored cases required before surgeons can achieve acceptably low complication rates.

Poster # 26

INTRAABDOMINAL HYPERTENSION IS MORE COMMON THAN PREVIOUSLY THOUGHT: A PROSPECTIVE STUDY IN A MIXED MEDICAL-SURGICAL INTENSIVE CARE UNIT

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Introduction: Intra-abdominal hypertension (IAH) is an under recognized phenomenon in critically ill patients. The true incidence has not been adequately determined by well powered, prospective studies which adhere to modern consensus definitions.

Methods: A prospective observational study of consecutive ICU patients admitted to a mixed medical-surgical ICU. Intra-abdominal pressures were measured twice daily using the modified Kron technique and were continued until discharge, death or removal of the indwelling catheter. IAH was defined according to published guidelines as a sustained intra-abdominal pressure > 12 mmHg. Multivariable analysis was used to identify risk factors associated with IAH and ICU mortality.

Results: 286 patients met our inclusion criteria. Thirty percent of patients had IAH on admission and a further 15% developed IAH during their ICU stay. The incidence of abdominal compartment syndrome (ACS) was 3.0%. Obesity, sepsis, mechanical ventilation and 24-hour fluid balance (>3 L) were all independent predictors for IAH. IAH occurred in 28% of non-ventilated patients. Admission type (medical vs. surgical vs. trauma) was not a significant predictor of IAH. ICU mortality was 20% and was significantly higher for patients with IAH (30%) compared to patients without IAH (11%). IAH of any grade was an independent predictor of mortality (OR 2.8; 95% CI 1.2-6.2).

Conclusion: IAH is common in both surgical and non-surgical patients in the intensive care setting and in this study, was found to be independently associated with mortality. Despite prior reports to the contrary, IAH develops in non-ventilated patients and in patients who do not have IAH on admission. Intra-abdominal pressure monitoring is inexpensive, provides valuable clinical information, and should be routinely performed in the ICU. Future work should evaluate the impact of early intervention for patients with IAH.

Poster # 27

RED CELL DISTRIBUTION WIDTH PREDICTING TRAUMA MORTALITY IS INDEPENDENT OF SEVERITY OF INJURY

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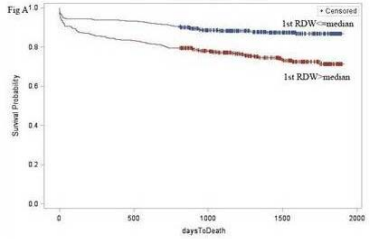
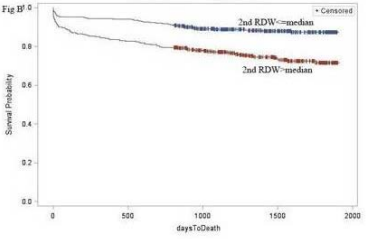
Introduction: Red blood cell distribution width (RDW), a component of the complete blood count, has been shown to be related to mortality in trauma. This correlation is not fully understood. The primary aim of this study was to determine if RDW prediction of mortality is trauma related or underlying health related. The secondary aim was to determine if the 2 nd RDW, drawn within ½ - 4 hours after the initial 1st RDW, is more predictive of mortality than the 1st RDW.

Methods: Data on all 919 trauma patients who had a 2nd RDW and were admitted to our trauma center from 8/2010 to 9/2013 were evaluated. Mortality data was obtained from the electronic medical record and Social Security Administration. The RDW was categorized by their medians (≥ vs < median).

Results: The 1st RDW was predictive of 1-year post-trauma all-cause mortality (OR=2.756, 95% CI: 1.757-4.323, $p<0.0001$), but not the 30-day mortality (OR=1.674, 95% CI: 0.982-2.854, $p=0.056$). The 2nd RDW was a predictor for either 30 day (OR=2.230, 95% CI: 1.348-4.028, $p=0.0019$) or 1-year mortality (OR=3.073, 95% CI: 1.959-4.822, $p<0.0001$). Both RDWs were associated with the age ($p<0.0001$) but not with ISS and hospital LOS. In multivariate logistic regression model, adjusted for age, sex, ISS and hospital stay, both RDWs were significant predictors of 1 year mortality ($p=0.0015$ for the 1st and 0.0006 for the 2nd), but not the 30-day mortality. In the Kaplan-Meier curve, both RDWs were significant predictors of the time to death ($p<0.0001$ for both) (Figures A and B). Paired student's *t*-test showed the 2nd RDW was significantly higher than the 1 st RDW ($p<0.0001$).

Conclusion: Our study demonstrated that RDW predicts all-cause trauma mortality but is independent of the severity of injury. RDW is a strong predictor for 1- year all-cause mortality, but not of 30-day mortality. RDW may be a good indicator of underlying health status and be clinically useful for long term prognosis after trauma. The 2nd RDW is most likely more reflective of the host physiological changes after body equilibrium. Further study investigating the relationship between RDW and outcomes is warranted.





Poster # 28

THE EPIDEMIOLOGY OF CHRONIC CRITICAL ILLNESS AFTER SEPSIS IN TRAUMA AND SURGICAL INTENSIVE CARE UNITS.

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Introduction: While inpatient mortality continues to decline after sepsis, those that previously died from early MOF now survive to a state of chronic critical illness (CCI), with persistent organ dysfunction, and poor long-term outcomes. We sought to define the epidemiology of CCI after sepsis in critically ill surgical patients.

Methods: This is a single center, prospective observational cohort study of trauma/surgical ICU patients treated for sepsis. Patients were screened and resuscitated via clinical decision support driven sepsis protocols. We compared risk factors and outcomes of septic patients who did, and did not develop CCI.

Results: Over 48 months, 147 surgical ICU patients with sepsis were enrolled in this cohort. Overall, septic patients were elderly (median age 62 yrs, IQR 53-70), had significant early physiologic derangement (median APACHE II score 22, IQR 15-26) and a prolonged hospital LOS (median 17 days, IQR 8-32). Illness severity was stratified as sepsis (n=28, 19%), severe sepsis (n=60, 41%) and septic shock (n=59, 40%) respectively, based on consensus criteria. Intra-abdominal sepsis was the primary infectious source (n=53, 36%) followed by pneumonia (n=25, 17%) and bacteremia (n=18, 12%). Overall inpatient mortality was 13%. Of those surviving ≥14 days, 47 (35%) developed CCI. As compared to those discharged from the ICU by day 14, septic patients that developed CCI had a significantly higher rate of "poor" hospital disposition (Long term acute care facility, Skilled nursing facility, hospice or inpatient death; 79 vs. 40%, $p<0.0001$). Multivariate analysis revealed severe sepsis/septic shock (OR 7.9, 95% CI 1.5-43.3), baseline low albumin (OR 4.6, 95% CI 1.5-13.9), and baseline elevated bilirubin (OR 2.1, 95% CI 1.3-3.3) as the only significant independent early (<24 hrs.) predictors of developing CCI.

Conclusion: While inpatient mortality rates continue to decrease, CCI is a common outcome after sepsis in critically ill surgical patients and is associated with discharge dispositions associated with poor long-term outcomes. Severity of the initial physiologic response to infection is the primary clinical predictor of development of CCI. Early clinical risk factors commonly associated with sepsis mortality, including age and comorbidities do not appear to be predictive of this morbid phenotype.

Poster # 29

Echocardiographic Correlates Associated with in-hospital Mortality in a Cohort of Trauma and Burn Patients

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Introduction: Hemodynamic Trans Esophageal Echocardiography (hTEE) is being used more frequently by trauma surgeons for rapid evaluation of cardiac function and adequacy of volume resuscitation. hTEE is less invasive than intravascular monitors and has been studied in other patient populations and found to have similar accuracy in measuring cardiac preload, left ventricular stoke volume and left ventricular ejection fraction. We sought to identify the relationship between hTEE findings and outcome.

Methods: Medical records of 93 trauma/ burn patients who underwent hTEE and were admitted to a Level 1 trauma center between July 2013 and June 2015 were reviewed. Left ventricular fractional area of change (LV FAC) was used as a surrogate of LV systolic function (cut-off= 40%). LV end diastolic area (EDA) (cut-off=10 cm2) was used as a surrogate of volume resuscitation. In separate analyses, demographic, clinical, and injury characteristics were compared between a) patients with low FAC (i.e., EF < 40%) versus normal FAC (i.e., ≥40%) and b) among patients with a normal EF, those who had a low EDA (i.e., <10) and a normal EDA using a t-test and Fisher's exact test for continuous and categorical variables, respectively. Cox regression analysis was used to calculate the association between EDA and death.

Results: The mean injury severity score among all patients was 23. There was no difference in outcome between those with low and normal FAC among all patients. Those with low FAC had higher systolic blood pressure at admission (p=0.0243) and higher serum lactate levels directly prior to the echocardiographic exam (p=0.0005). Among patients with normal FAC, those with low EDA had higher serum lactate levels directly prior to echocardiographic exam (p=0.0076) and were less likely to be male (p=0.0303). Among those with normal FAC, those with low EDA were over 3 times as likely to die (RR 3.33, 95% CI 1.37-8.08), this association remained significant after adjustment for serum lactate at echocardiography (RR 3.79, 95% CI 1.25-11.53).

Conclusion: Systolic dysfunction as evidenced by low FAC is associated with high serum lactate. In patients with normal systolic function, under-resuscitation as evidenced by low LV EDA is an independent predictor of in-hospital mortality. Echocardiography is a valuable tool in hemodynamic evaluation of trauma/ burn patients.

Poster # 30

THE LOW MOLECULAR WEIGHT FRACTION OF HUMAN SERUM ALBUMIN AS A POTENTIAL THERAPEUTIC FOR INFLAMMATORY CONDITIONS DUE TO ITS ROLE IN THE COX2 PATHWAY

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Introduction: The ability to decrease inflammation and promote healing is important for a variety of disease states, including the local inflammation observed after acute or sustained physical trauma as well as that documented in systemic inflammatory response syndrome (SIRS). Cyclooxygenase 2 (COX2) has an established role in inflammation, and while it is generally thought of as a pro-inflammatory molecule, COX2 has also been shown to be critical to the resolution and healing that occurs after the initial phase of the immune response. In this study, we investigated the effects of the low molecular weight fraction of human serum albumin (LMWF-5A), an agent that has proven to decrease pain and inflammation in osteoarthritis patients, on the expression of members of the COX2 pathway and its downstream products, prostaglandins (PGs).

Methods: Primary synovial fibroblasts were treated with LMWF-5A or saline as a control with or without the addition of cytokine (IL-1β or TNFα) to elicit an inflammatory response. The cells were harvested for RNA and protein at 2, 4, 8, 12, and 24 h, and their media was collected at 24 h for the analysis of secreted products. *COX2* mRNA expression was determined by qPCR, and COX2 protein expression was determined by western blot analysis. The levels of prostaglandin E2 (PGE2) and prostaglandin D2 (PGD2) in the media were quantified by competitive ELISA.

Results: In the presence of cytokine, LMWF-5A increased the expression of both *COX2* mRNA and COX2 protein, and this increase was significant compared to that observed with cytokine alone. Finally, the levels of PGE2 were increased only in TNFα-stimulated cells; however, in both IL-1β- and TNFα-stimulated cells, LMWF-5A increased the release of the anti-inflammatory PGD2.

Conclusion: The addition of LMWF-5A changes COX2 expression and the downstream effects of the COX2 pathway under inflammatory conditions. Specifically, LMWF-5A appears to trigger increased anti-inflammatory PG signaling. Thus, LMWF-5A could be used as putative therapeutic for a number of inflammatory conditions via its action on the COX2 pathway. For instance, it could be used injected locally or intravenously following trauma to ameliorate the induced immune response.

Poster # 31

ELIMINATION OF THE POST PROCEDURE CHEST X RAY USING ULTRASOUND AFTER CENTRAL LINE PLACEMENT

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Introduction: Routine chest radiography following central venous catheterization (CVC) is considered the standard of care. The purpose of this practice is twofold: 1) to identify pneumothorax (PTX), and 2) to rule out catheter malposition by verifying placement in the central venous circulation. This study investigates the utility of ultrasound (US), as compared to chest radiography (CXR), in addressing these two questions.

Methods: All patients, both trauma and surgical critical care, who underwent subclavian (SC) or internal jugular (IJ) CVC in the trauma intensive care unit at our level one trauma center, between the dates of 5/27/2015 and 2/29/2016, were included. These patients underwent surgeon – performed US examination, with instillation of 10mL of saline flush through the distal port of the catheter, immediately after catheter placement. Catheter malposition was ruled out with immediate (<1 second delay) visualization of turbulent flow into the right heart on parasternal or subxiphoid view. Catheter malposition was suspected if nonvisualization of turbulent flow, or delayed visualization of turbulent flow (>1 second), was noted. Ultrasound examination for PTX was then performed in three sites bilaterally using B mode imaging. CXR was obtained on all patients for comparison. Data were prospectively collected in a database. Retrospective analysis was performed to compare US examination to CXR for both line positioning and pneumothorax.

Results: 144 central venous catheterizations and subsequent ultrasound examinations were performed on 129 patients. One iatrogenic PTX (0.6%) was noted on CXR, and this was also noted on US. This iatrogenic pneumothorax was treated with tube thoracostomy prior to the CXR images being made available for viewing. Including pre-existing traumatic pneumothoraces, a total of six PTX were noted on CXR. All were also noted on US. Six malpositioned lines (4.1%) were noted on CXR, all of which were noted on US. The sensitivity and specificity for US examination for PTX, as compared to CXR, were both 100%. In patients with adequate acoustic windows, the sensitivity and specificity for US verification of catheter placement in the central circulation, as compared with CXR, was 100%. In one patient, who underwent two CVC's, the US examination for catheter position was inadequate due to poor acoustic windows and inability to adequately image the right heart.

Conclusion: Our data suggest that the elimination of routine CXR following CVC, instead performing US examination to assess for catheter position and pneumothorax, is safe. Use of routine US examination, rather than CXR, potentially decreases delays to use of the CVC while eliminating the costs associated with performance of CXR. While additional studies are needed to prove external validity, this study supports the replacement of routine CXR with routine US examination following central venous catheter placement.

	PTX on CXR	No PTX on CXR
PTX on US	6	0
No PTX on US	138	138

	CVC Malposition on CXR	No CVC Malposition on CXR
CVC Malposition on US	6	0
No CVC Malposition on US	138	138

Poster # 32

MILD TO MODERATE TO SEVERE: WHAT DRIVES PROGRESSION OF SEVERITY OF ARDS IN TRAUMA PATIENTS?

Pamela Daher MD, Brent J. Ford BS, Sadia Ali MPH, Adam S. Hensely BS, Lawrence Brown Ph.D., Jayson D. Aydelotte MD, Thomas B. Coopwood* MD, Pedro G. Teixeira MD, Carlos V. Brown* MD, Dell Medical School At The University Of Texas At Austin

Introduction: Acute respiratory distress syndrome (ARDS) is a complex lung inflammatory process with multifactorial etiologies. Risk factors for the development of ARDS, as defined by the American-European consensus conference, have been extensively studied. However, risk factors associated with the progression of severity of ARDS, as defined by the Berlin criteria (PaO2:FiO2 [P:F] ratio < 300), are poorly understood.

Methods: A retrospective chart and trauma registry review identified trauma patients admitted to our surgical intensive care unit who developed ARDS within a 5-year period (2010-2015). ARDS was defined according to the Berlin definition. The primary outcome was development of mild (P:F<300), moderate (P:F<200) or severe (P:F<100) ARDS. A logistic regression model was then used to identify risk factors associated with developing ARDS as well as progression of severity of ARDS.

Results: Of 2704 trauma patients admitted to our SICU, 432 (16%) developed ARDS. Of those, 100 (23%) were categorized as mild, 176 (41%) as moderate and 156 (36%) as severe ARDS. The 2272 trauma patients that did not develop ARDS served as our control group. Patients who developed ARDS were more often transfused (71% vs. 38%, p<0.0001) and received more units of packed red blood cells (PRBC: 6 vs. 1, p<0.0001), plasma (4 vs. 0.7, p<0.0001), and platelets (1.1 vs. 0.2, p<0.0001). After logistic regression, independent risk factors associated with developing ARDS included male gender (OR=1.3, CI=1.0-1.8, p=0.049), blunt mechanism (OR=2.5, CI=1.4-4.4, p=0.003), severe (AIS >/=3) head (OR=1.4, CI=1.1-1.9, p=0.01) and chest (OR=2.4, CI=1.9-3.2, p<0.0001) injuries, total PRBC transfusion (OR=1.1, CI=1.0-1.2, p=0.009) and total combined (PRBC, plasma, and platelets) transfusion of blood products (OR=1.05, CI=1.0-1.1, p=0.01). Independent risk factors for progression of severity of ARDS from mild to moderate to severe included severe (AIS>/=3) chest injury (OR=2.1, CI=1.5-3.1, p<0.0001) and total plasma transfusion (OR=1.03, CI=1.0-1.1, p=0.01). Patients who developed ARDS had a higher mortality (20% vs. 3%, p<0.0001)

Conclusion: Male gender, blunt trauma, severe head and chest injuries, and PRBC as well as total blood product transfusion are associated with ARDS as defined by the Berlin criteria. Progression of severity from mild to moderate to severe ARDS is associated with severe chest trauma and volume of plasma transfusion.

Poster # 33

THE METABOLOMIC EFFECTS OF ENDOTOXIN ADMINISTRATION IN HEALTHY HUMAN VOLUNTEERS

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Introduction: The initial systemic manifestations of inflammation, resulting from injury or infection are mechanistically and temporally linked with activation of innate immunity and neuro-endocrine axes. Although controlled administration of an innate immune activating ligand, (i.e. Toll-like receptor-4 agonist, endotoxin) induces inflammatory mediator production and robust phenotypic manifestations in a dose-response manner there have been limited studies documenting the metabolomic profiles created by endotoxin challenge in humans. In the present study, we characterize these effects in healthy human volunteers.

Methods: Fifteen human volunteers received intravenous endotoxin (2ng/kg); four received saline placebo. Blood samples were obtained at various time points (t=0, 1, 2, 6, 24hr) and analyzed using a proprietary solvent extraction method with gas chromatography (GC/MS) and liquid chromatography mass spectroscopy (LC/MS/MS) (Metabolon) to identify the concentrations of 363 biochemicals at various time points. Study subjects were compared to the placebo group and expressed as fold change. ANOVA identified moieties that differed between groups ($p<0.05$).

Results: After a single endotoxin challenge, significant metabolomic changes occurred in healthy volunteers which suggest acute proteolysis, increased glucose utilization, up-regulation of omega-fatty acid oxidation, altered nitric oxide formation, acute hemolysis, altered bile acid metabolism, and altered cellular respiration. See Figure 1.

Conclusion: The present study documents the effects of TLR4 agonist administration on metabolic pathways in healthy human subjects. These observations emphasize the dynamic nature of acute systemic inflammation and indicate that metabolic changes are evident within hours of exposure to pathogen-associated molecular patterns (PAMPs). Future work should focus on identifiying predictive metabolic patterns in critically ill patients which may aid in the early identification of sepsis or other acute inflammatory processes.

Comparison mean values significantly different:
$p \le 0.05$, fold of change ≥ 1.00
$p \le 0.05$, fold of change < 1.00

Comparison mean values approaching significance:
$0.05 < p < 0.10$, fold of change ≥ 1.00
$0.05 < p < 0.10$, fold of change < 1.00

Super Pathway	Sub Pathway	Biochemical Name	Endotoxin /Placebo Fold Change				
			0h	1h	2h	6h	24h
Amino Acid	Histidine metabolism	histidine	1.19	1.19	1.07	1.07	1.25
		3-methylhistidine	4.33	3.97	3.85	3.40	1.51
	Lysine metabolism	glutarate (pentanedioate)	1.10	0.95	1.03	2.03	1.55
		pipecolate	1.86	1.74	1.60	1.52	1.35
	Valine, leucine and isoleucine metabolism	isoleucine	1.26	1.07	1.01	0.81	1.13
		leucine	1.21	1.10	1.09	0.92	1.17
		valine	1.22	1.12	1.10	0.98	1.15
		4-methyl-2-oxopentanoate	1.22	1.14	1.24	1.28	1.17
	Creatine metabolism	creatine	1.71	1.72	1.64	1.48	2.09
Carbohydrate	Glycolysis, gluconeogenesis, pyruvate metabolism	3-phosphoglycerate	1.35	0.97	0.64	1.56	2.48
		pyruvate	0.92	0.99	1.60	1.40	0.95
		lactate	1.08	1.11	1.61	1.46	1.00
Lipid	Essential fatty acid	docosapentaenoate	2.39	1.34	1.98	2.78	2.36
	Fatty acid, dicarboxylate	sebacate (decanedioate)	1.02	1.14	1.87	1.58	1.00
		tetradecanedioate	1.14	1.27	1.58	2.34	0.86
		hexadecanedioate	1.07	0.97	1.15	1.97	1.23
		octadecanedioate	1.03	0.97	1.00	1.65	1.04
	Bile acid metabolism	cholate	5.28	2.98	1.96	1.29	11.13
		glycocholate	1.28	1.13	2.15	1.12	0.77
	Sterol/Steroid	cholesterol	1.12	1.06	1.12	1.03	1.29
		cortisol	1.34	2.01	3.87	1.74	1.25
		corticosterone	1.03	1.13	3.10	0.88	1.33
		cortisone	1.07	1.24	1.21	1.41	1.21
		pregn steroid monosulfate*	1.04	1.06	1.44	1.93	1.04
		pregnenolone sulfate	1.31	1.48	2.78	1.94	1.06
Nucleotide	Purine metabolism	hypoxanthine	1.12	1.05	1.13	1.54	1.58
		adenosine 5'-monophosphate (AMP)	1.26	1.48	1.44	2.43	1.95
		adenosine 5'-diphosphate (ADP)	1.53	1.76	1.67	2.98	2.38
		adenosine 5'-triphosphate (ATP)	1.29	1.37	1.11	1.32	1.50
Cofactors	Hemoglobin and porphyrin metabolism	heme	0.97	0.45	0.38	1.15	1.95
		L-urobilin	1.68	1.69	2.88	3.43	2.82
		urobilinogen	0.58	0.38	0.58	0.45	0.72

Poster # 34

Apneic Oxygenation Decreases the Incidence of Desaturation in Trauma Patients Undergoing Rapid Sequence Intubation

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Introduction: Rapid sequence intubation (RSI) is the preferred technique for securing a definitive airway in trauma patients. Hypoxia is an uncommon yet potentially morbid complication of intubation. Apneic oxygenation, which involves the administration of continuous high-flow oxygen via nasal cannula in addition to standard preoxygenation techniques, has been shown to increase the duration of normoxia and prevent desaturation in various patient populations. Data supporting the use of this technique in trauma patients are limited. We hypothesized that apneic oxygenation would be associated with a decreased incidence of desaturation in trauma patients undergoing RSI.

Methods: We performed a 1-year retrospective analysis of our Level 1 trauma center registry to identify all adult patients undergoing intubation in the trauma resuscitation bay. Patients who were intubated in the field and those who did not survive beyond the resuscitation room were excluded. Variables collected included demographics, body mass index, comorbidities, mechanism of injury, Injury Severity Score (ISS), indication for intubation, and details of the intubation (provider specialty, number of attempts, grade of view). Patients who underwent apneic oxygenation were compared to those who did not. The main outcome measure was the occurrence of desaturation ($SpO2 \leq 92\%$) during intubation. Multivariable logistic regression analysis was performed to identify independent predictors of desaturation.

Results: Of 144 patients, 74 patients (51%) underwent apneic oxygenation. There were no significant differences with regards to age, gender, or mechanism. Type and severity of chest injuries were likewise similar. Patients undergoing apneic oxygenation had a lower ISS (24 ± 14 vs. 29 ± 20, $p=0.03$), lower incidence of morbid obesity (40% vs. 60%, $p=0.02$), and were less likely to be hypotensive (37% vs. 58%, $p=0.02$). Although there was a significant difference in the incidence of desaturation between patients who did and did not undergo apneic oxygenation (24% vs. 44%, $p=0.02$), the lowest SpO2 did not differ. On multivariate analysis, after controlling for ISS, morbid obesity, hypotension, and hypoxia as the primary indication for intubation, apneic oxygenation was found to be protective for desaturation (OR=0.4; 95% CI=0.16-0.91, $p=0.03$), whereas morbid obesity was associated with an increased risk for desaturation (OR=2.7; 95% CI=1.15-6.56, $p<0.01$).

Conclusion: Apneic oxygenation is associated with a decreased incidence of desaturation in trauma patients undergoing RSI. Further study is required to determine the optimal indications, dose, and patient populations most likely to benefit from this minimally invasive and easy to perform technique.

Poster # 35

INFECTION DIAGNOSIS IN SYSTEMIC INFLAMMATION BY INNATE IMMUNE RECEPTOR EXPRESSION PATTERN

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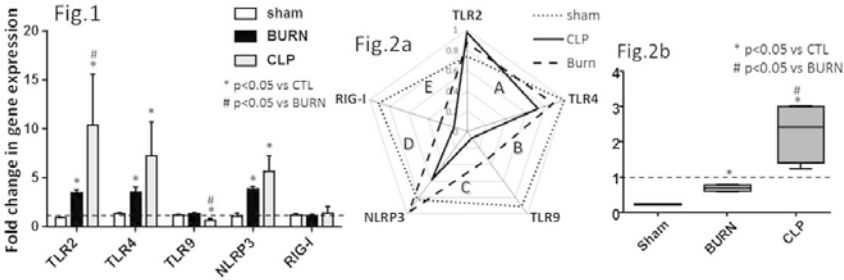
Introduction: It is difficult to diagnose infection by single biomarker in patients who are under condition of systemic inflammation. We hypothesized that expression pattern of innate immune receptors may distinguish infection from systemic inflammation of uncertain etiology.

Methods: To compare infectious inflammation and sterile inflammation, we employed cecal ligation and puncture (CLP) and 20% full thickness burn injury (Burn) model. C57BL/6 mice underwent sham, CLP, or Burn. 24 hours later, mice were sacrificed, and total RNA was extracted from whole blood. Using quantitative real-time PCR, we investigated gene expression of innate immune receptors including TLR2, TLR4, TLR9, NLRP3 and RIG-I. To evaluate all the gene expression together as patterns, each value was plotted on the radar chart and the area was calculated. To compare gene expression patters as graphic characters, area A / (B+C+D+E) was defined as bacterial infection index (BI) and evaluated.

Results: Gene expression of TLR2, TLR4 and NLRP3 was significantly increased in both CLP and Burn compared to sham ($p<0.05$). Gene expression of TLR9 was significantly decreased in CLP compared to both sham and Burn ($p<0.05$). RIG-I gene expression did not show any difference (Fig.1). In the radar chart, each group showed distinctive gene expression patterns (Fig.2a). BI in CLP was significantly higher than sham and Burn ($p<0.05$, sham: min=0.19, max=0.25, mean=0.23, CLP: min=1.24, max=3.01, mean=2.26, Burn: min=0.58, max=0.77, mean=0.67), and BI higher than 1.0 distinguished infection clearly from the other groups (Fig.2b).

Conclusion: Gene expression profile of innate immune receptors distinguishes infection from sterile systemic inflammation. BI can assess multiple factors together, and will be convincing marker to diagnose infection.



Poster # 36

RISK FACTORS FOR EXTUBATION FAILURE AT A LEVEL 1 TRAUMA CENTER: DOES THE SPECIALTY OF THE INTENSIVIST MATTER?

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Introduction: Failure of extubation following a period of mechanical ventilation in critically ill patients is associated with higher morbidity, mortality, and longer ICU length of stay. Although predictors of failed extubation have been previously determined in ICU cohorts, relatively less attention has been directed toward this issue in trauma patients. The aim of this study was to identify predictors of extubation failure among trauma patients in a multidisciplinary ICU setting.

Methods: A prospective observational study of extubation failures (EF) was conducted at an ACS Level 1 trauma center over a three-year period (2011-2013). Case control patients (CONT) were then compared to the study group (EF) with respect to demographic and clinical characteristics as well as outcomes. Failure of extubation was defined as reintubation within 72 hours following a planned extubation. Patients who self-extubated or were less than 15 years of age were excluded from the study.

Results: During the study period, 7,830 patients were admitted to the trauma service and 1,098 (14%) underwent mechanical ventilation. 63 patients met inclusion criteria for the EF group, and 63 successful extubations comprised the CONT group. The overall rate of extubation failure was 5.7% and mean time to reintubation was 13.0 hours. Groups (EF vs. CONT) were similar for ISS (21 vs. 21), GCS (12 vs. 11), number of comorbidities (2 vs. 2), injury mechanism (blunt 79% vs. 74%), and BMI (27.9 vs. 27.2). In addition, groups were similar with respect to weaning protocol compliance (84% vs. 89%, $p = 0.57$). The EF group had significantly increased ICU LOS (15.7 vs. 7.4 days, $p < 0.001$), ventilator days (13.3 vs. 4.8, $p < 0.001$) and mortality (9.5% vs. 0%, $p = 0.03$). Multiple regression analysis identified that EF was associated with significantly increased odds of: (i) temperature > 38 ºC at the time of extubation (OR 5.9, 95% CI 1.7 – 20.8), and (ii) non-surgeon intensivist consultation (OR 24.2, 95% CI 5.5 – 105.9).

Conclusion: Extubation failure is associated with increased length of stay, ventilator days, and mortality in trauma patients. Fever at time of extubation is significantly associated with extubation failure, and the presence of such should give pause in the decision to extubate. Non-surgeon intensivist involvement increases the risk of extubation failure, and a surgical critical care service may be most appropriate for the management of mechanically ventilated trauma patients.

Poster # 37

THE LOW MOLECULAR WEIGHT FRACTION OF HUMAN SERUM ALBUMIN (HSA) INHIBITS NFκ B SIGNALING

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Introduction: A major pathway stimulated by trauma-induced inflammation is the NFκ B signaling network. NFκ B signaling results in downstream cellular responses that include production of pro-inflammatory cytokines, such as IL-1β and TNFα. Systemic inflammation may promote multiple-organ failure during severe trauma, in which NFκ B signaling plays a central role. Historically, severe trauma patients have been treated with Human Serum Albumin (HSA) to decrease tissue edema and for fluid resuscitation. We have identified anti-inflammatory properties in the Low Molecular Weight Fraction of HSA under 5,000 Daltons (LMWF-5A) and sought to determine whether it inhibits NFκ B signaling.

Methods: Human embryonic kidney cells (HEK-293T) expressing a luciferase reporter gene driven by four NFκ B-response elements were treated with either saline control or LMWF-5A in the presence of IL-1β or TNFα. Luciferase activity was measured 3h following cytokine exposure and normalized for cell viability. we also used human synovial primary fibroblasts (HSF-OA). To determine differential gene expression, RNA sequencing of whole transcriptome and miRNA expression was performed on HSF-OA either treated with saline or LMWF-5A for 24h with or without IL-1β stimulation. Significantly differentially expressed transcripts were identified in saline versus saline+IL-1β (SvS+I) and LMWF-5A versus LMWF-5A+IL-1β (LvL+I). Ingenuity® Pathway Analysis (IPA) was used to determine relevant gene networks differentially regulated by LMWF-5A versus saline in IL-1β-stimulated cells.

Results: In TNFα-stimulated HEK-293T cells, NFκ B transcriptional activity was decreased by ~30% in LMWF-5A treated cells. A known transcriptional target gene of NFκ B, Interleukin-8 (IL-8) was differentially induced when comparing SvS+I and LvL+I gene lists, indicating a ~700-fold decrease in IL-8 mRNA induction in the presence of LMWF-5A. Differential expression of several mediators of NFκ B signaling were also observed, including NFκ B inhibiting kinase (NIK), NFκ B2, and RELB, all members of the non-canonical NFκ B pathway. All of these transcripts decreased or did not increase in the presence of LMWF-5A versus saline when cells were stimulated with IL-1β. Furthermore, treatment with LMWF-5A completely blocked expression of miR-486. By repressing negative NFκ B feedback loops, miR-486 perpetuates NFκ B signaling, lending more support to LMWF-5A inhibition of NFκ B signaling.

Conclusion: Together, these data support the hypothesis that LMWF-5A inhibits NFκ B signaling on a global level through regulation of NFκ B relevant transcripts and miRNA. Systemic administration of LMWF-5A may ameliorate inflammation in trauma patients.

Poster # 38

SEVERITY OF ALCOHOL WITHDRAWAL SYNDROME IS ASSOCIATED WITH MORBIDITY BUT NOT MORTALITY OR INJURY CHARACTERISTICS IN TRAUMA PATIENTS

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Introduction: Alcohol use and abuse is prevalent among patients with traumatic injury, increasing the risk of Alcohol withdrawal syndrome (AWS). AWS is associated with high morbidity and increased LOS, with disparate findings on its effect on mortality. The objective of this study was to determine incidence and outcomes of AWS, and determine if severity of AWS is associated with clinical outcomes, patient demographics, and injury characteristics.

Methods: This was a multicenter, retrospective registry cohort study of 28,101 patients with trauma conducted over 5 years (2010-2014). AWS was defined by physician diagnosis, and was further categorized by AWS severity using the highest recorded Clinical Institute Withdrawal Assessment for alcohol (CIWA-Ar) score into minor (<8), moderate (8-15), severe (16-29) and extreme (> 29). Chi-square trend tests and ANOVA were used to examine the association between AWS severity and demographics (age, gender, race, arrival blood alcohol concentration), injury characteristics (ISS, injury mechanism, presence of head injury) and outcomes (mortality, hospital LOS, sequelae of AWS). Multivariate logistic regression and ANCOVA were used to determine if AWS severity was associated with outcomes.

Results: AWS developed in 0.88% (n=248), and was mild in 9%, moderate in 21%, severe in 49%, and extreme in 21%. Severity of AWS was not associated with any demographic or injury characteristics ($p > 0.40$ for all). The most frequent sequelae of AWS were respiratory distress (24%), encephalopathy (21%), delirium tremens (11%) and withdrawal seizures (6%); severity of AWS was associated with delirium tremens only (p=0.001). Hospital LOS was significantly prolonged with development of AWS and with increasing AWS severity, before and after adjustment (table 1, $p < 0.001$). Mortality was not significantly different by presence of AWS or severity of AWS, prior to adjustment (table 1, p=0.96) or after adjustment for age and cause of injury (OR: 1.16, 0.77, and 0.81 for moderate, severe, and extreme vs. mild severity; p=0.98).

Conclusion: We were unable to predict the severity of AWS with injury or demographic characteristics. Although mortality was not increased with AWS, there is considerable morbidity and use of hospital resources associated with more severe manifestations of AWS in patients with trauma.

Table 1. Outcomes in trauma patients by severity of Alcohol Withdrawal Syndrome (AWS)

AWS by severity	n (%)	Median (IQR) ISS	Mortality	Median (IQR) LOS	LSM^&^ LOS, adjusted
No AWS	27,853	9 (4-13)	3.45%	3 (1-5)	4.79
Mild AWS (CIWA < 8)	19	12 (9-21)	5.26%	6 (4-21)	12.98
Moderate AWS (CIWA 8-15)	45	10 (5-18)	4.44%	9 (5-19)	14.52
Severe AWS (CIWA 16-29)	106	13 (7-17)	2.86%	15 (9-24)	16.80
Extreme AWS (CIWA >29	46	11 (9-14)	2.22%	17 (10-24)	18.83
p value		0.81	0.96	**< 0.001**	**< 0.001**

*32 patients with AWS were missing CIWA scores

**Adjusted for ISS and age

Poster # 39

NATIONAL ESTIMATES OF THE USE AND OUTCOMES OF EXTRACORPOREAL MEMBRANE OXYGENATION AFTER ACUTE TRAUMATIC INJURY

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Introduction: The use of extracorporeal membrane oxygenation (ECMO) as salvage therapy for patients with severe Acute Respiratory Distress Syndrome (ARDS) is gaining greater acceptance among trauma intensivists. To date, national estimates regarding the use of ECMO as a viable treatment in post-traumatic severe ARDS have not been reported. The objective of this study was to review ECMO usage in trauma patients in the United States.

Methods: The Nationwide Inpatient Sample (NIS) from years 2002 to 2012 was queried for patients aged 15 and older treated with ECMO who had one or more acute traumatic injuries as defined by International Diagnostic Codes, ninth edition (ICD-9). The primary outcomes of interest were incidence of ECMO and overall inpatient mortality in patients receiving ECMO.

Results: A total of 1,347 patients were identified in the NIS database that had both ECMO performed and ICD-9 codes consistent with trauma. The majority of patients identified were between the ages of 15-29 years (31.4%) and male (65.5%). The incidence of ECMO for patients after traumatic injuries has increased 66 fold over the 10-year period. In hospital mortality decreased from 100% at the beginning of the study to 42% at the conclusion (mean mortality was 48.0% overall) with a decreasing trend over the study period that approached statistical significance ($p=0.06$).

Conclusion: While ECMO use in patients with severe ARDS in the post-trauma setting remains controversial, there is an increasing trend to utilize ECMO nationwide, suggesting an increasing acceptance and/or increased availability at trauma centers. With a subsequent decrease in mortality over the study period, the use of ECMO as a salvage method in trauma patients with refractory ARDS remains a potentially viable option. Additional evaluation in a prospective manner could further clarify risks and benefits.

Poster # 40

PERIOPERATIVE RESUSCITATION GUIDED BY TRANSESOPHAGEAL ECHOCARDIOGRAPHY: AN INITIAL EXPERIENCE

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Introduction: Traditional measures of evaluating volume status, namely central venous pressure (CVP), pulmonary artery occlusion pressure, and physical exam are often challenging to interpret and potentially unreliable in critically ill and ventilated patients. Echocardiography has become widely accessible and routinely used in the critical care setting as a tool to evaluate the hemodynamics of patients. The use of transesophageal echocardiography (TEE) for peri-operative resuscitation in trauma care has been limited by cost and clinical skill set. The authors report a series of surgeon-performed hemodynamic TEE.

Methods: Records of intubated patients treated in a regional Level I trauma center who underwent hemodynamicTEE (hTEE) between December 2012 and April 2015 were reviewed. The clinical course of each patient was recorded. Limited TEE views including superior vena cava (SVC), mid esophageal 4-chamber (ME4CH), and short axis transgastric (TGSAV) were prospectively collected and stored on an hTEE system (ImaCor, Inc, NY, USA). The video observations were collected prospectively and then retrospectively evaluated for quality. All bedside interpretations of TEE images were retrospectively reviewed for accuracy and quality by a surgical intensivist with training in echocardiography. A 3-point quality scale (1:Poor, 2:Average. 3:Excellent) was used for evaluation of each recorded image.

Results: A total of 109 patients received formal hemodynamic evaluation using a TEE over a 28-month period. The mean age of the cohort was 48.1 (SD:18.2) years with the majority of male gender (70.6%). There were no complications identified related to TEE probe placement. A total of 1212 observations were made over the study period with an average of 11.0 (SD:9.4) observations recorded per patient. Each observation period took an average of 12min and 32sec (SD: 9min, 11sec). The majority of the time TGSAV (46.1%) views were established followed by ME4CH (30.2%) and SVC (23.7%). The TGSAV was mostly commonly used for evaluation of hemodynamic function. Best quality images were TGSAV (2.82/3) followed by ME4CH (2.51/3) and SVC (2.07/3). The mean SVC Collapsibility Index was 0.28 (SD:0.16) and the left ventricle end diastolic area (LVEDA) was less than 10cm 2 53.2% of the time prompting further fluid resuscitation. Sixty-three (57.8%) patients had at lease two documented TEE evaluation periods. Of those with repeated observations, LVEDA and SVC were noted to be improved 76.2 and 63.2% of the time, respectively, suggesting favourable responses to fluid administration.

Conclusions: Perioperative hemodynamic evaluation using TEE is feasible and provides accurate assessment of cardiac function and support of resuscitative measures. The image quality and hemodynamic evaluation was best evaluated using the TGSAV. Serial exams provide both quantitative and qualitative response to fluid administration. The integration of TEE is a useful adjunct to peri-operative hemodynamic evaluation in critically ill patients.

Poster # 41

Combat Vascular Injury: Influence Of Mechanism Of Injury On Outcome

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Introduction: Combat trauma commonly results in vascular injury. Worse outcomes have been reported anecdotally for vascular injuries associated with blast versus gunshot wound (GSW) trauma. Aims. We wished to examine the UK deployed military vascular injury experience during Operations Telic and Herrick. Using injury severity matched blast and GSW cohorts, we investigated differences in graft thrombosis, haemorrhage, infection, mortality and amputation.

Methods: Joint Theatre Trauma Registry cases (blast or GSW, vascular injury, head injury AIS<6, recordable R3 BP and HR) were examined using multivariate analysis, Chi2, or t-tests with post-hoc correction.

Results: 992 patients with vascular injuries were identified (2003-2014); 115 had arterial injuries, met eligibility criteria and had follow-up data. Mortality was 10.44%, median survival 1 day (IQR 0.0–6.0). Injured sites were: Lower limb 27.83% (32), upper limb 21.74% (15), trunk 10.44% (12), neck 7.83% (9), and distal (to popliteal / brachial) extremity 32.17% (37). 7.83% underwent a proximal amputation (median 10 days (IQR 2.50 – 224.50) from admission). Interventions were interposition graft (28.70%), ligation (22.61%), shunt (7.86%), patch 3.48% or primary repair 11.30%. The remainder underwent proximal amputation or exploration (blast / GSW groups p=0.073). Blast (N=80) and GSW (N=35) groups had comparable demographics, extraction time, number and distribution of arterial injuries, ISS / AIS≥3, and tourniquet use. The blast group had more regions injured, blood products, amputations, and more theatre minutes (247.3± 140.6 vs 160.2± 91.9; p=0.002)). No differences were identified in overall complications (28.75% blast vs 31.23% GSW (p=0.475), haemorrhage, infection, mortality, amputation or graft thrombosis (11.25% blast vs 2.86% GSW (p=0.144).

Conclusion: Despite no differences in overall blast and GSW complications, graft thrombosis was four times as likely with blast aetiology. Combining these data with similar datasets amongst coalition patients may allow us to understand the true influence of blast on outcome in vascular trauma.

Poster # 42

IF IT'S BROKE, FIX IT: REPAIR OF MAJOR LOWER EXTREMITY VEIN INJURIES REDUCES COMPLICATIONS COMPARED TO LIGATION

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Introduction: Both repair and ligation approaches have been well described for traumatic lower extremity venous injuries. However, comparative outcomes data demonstrating which approach might be preferable and under what circumstances, are limited. We therefore sought to compare outcomes of venous repair versus ligation for such injuries at an urban level-one trauma center.

Methods: We performed a retrospective review of patients presenting with traumatic lower extremity venous injuries to a large level-one academic, urban trauma center between 2004 and 2014. All patients with identified injuries to the external iliac (EIV), common femoral (CFV), femoral (FV), and popliteal veins (PV) who underwent repair or ligation were included. Patient demographics, vein injured, operative details, hospital course, and outcomes were recorded. Limb complications were defined as delayed (after initial operation) fasciotomy, delayed amputation, wound complications, symptomatic edema, ulceration and persistent pain.

Results: Our sample included 107 patients with the following anatomic distribution of injuries: EIV in 22.4% (n=24); CFV in 35.5% (n=38); FV in 16.8% (n=18); and PV in 25.2% (n=27). Ligation was performed in 64% (n = 68) of patients while repair was performed in 36% (n = 39). There were no differences in age, sex, length of stay, injury severity score, and length of ICU stay. Limb complications were observed in 28% (n=30) of injuries and were more likely to be seen with ligation procedures than with repair, 36.8% (n=25) versus 12.8% (n=5) (p=0.008) respectively. Furthermore, 37% (n=40) of patients received fasciotomies at the initial presentation and was observed in 41% (n=28) of the ligation group and 31% (n=12) in the repair group (p=0.3). Delayed fasciotomy was required in 12% (n=13) of injuries and was not predicted by the type of management (p=0.1). Delayed amputations (n=4) were equally seen in the ligation and repair groups (p=0.6). Observed 30-day mortality did not differ between the two groups (p=0.4).

Conclusion: Repair of lower extremity venous injuries is associated with lower risk for limb complications. Specific outcomes including delayed amputation and delayed fasciotomy were not influenced by the type of management selected. Therefore either modality is reasonable for achieving limb salvage in this patient population. However if allowable venous repair may be considered to decrease limb complications and morbidity. Long-term data comparing venous ligation and repair may offer additional insight for management selection.

Poster # 43

RESILIENCE, DEPRESSION, AND POSTTRAUMATIC STRESS DISORDER IN ORTHOPEDIC TRAUMA PATIENTS

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Introduction: Depression and posttraumatic stress disorder (PTSD) are prevalent in orthopedic trauma and are predictive of poor outcomes related to disability, pain intensity and overall functionality following injury. Resilience is defined as the ability to adapt under stress or adversity and can be measured with the Connor-Davidson Resilience Scale 10 item (CD-RISC 10). This study examines the prevalence of and relationship between resilience, depression and PTSD in orthopedic trauma patients.

Methods: One hundred and sixty orthopedic trauma inpatients completed measures for depression (Patient Health Questionnarie-8 Item (PHQ-8), PTSD symptoms (Primary Care PTSD screen (PC-PTSD) and PTSD Checklist-Civilian version (PCL-C)), and resilience (CD-RISC 10) at baseline and 12 months post-injury. Resilience scores were categorized as low, intermediate, or high and compared with depression and PTSD evaluations at baseline and 12 months post-injury.

Results: Depression was seen in 28% of patients at baseline and 29% at 12 months. PTSD symptoms were prevalent in 23% at baseline and 21% at 12 months. Resilience scores at baseline and 12 months were divided into three categories: low (14%, 16%, respectively), intermediate (70%, 68%), and high (16%, 16%). There was no significant difference in the prevalence of depression, PTSD symptoms or resilience scores at baseline and 12 months post-injury. There was a significant relationship between resilience and depression at both baseline and 12 months ($p=0.0015$, $p=0.0003$) and between resilience and PTSD symptoms at baseline and 12 months ($p=0.024$, $p=0.0002$).

Conclusion: Low resilience scores are correlated with the presence of depression and PTSD symptoms at both baseline and 12 months post-injury in orthopedic trauma patients. Prevalence of depression and PTSD are significant immediately following (28%, 23%, respectively) and 12 months after traumatic injury (29%, 21%). These results highlight the need for early screening and intervention for depression and PTSD. They further demonstrate the importance of resilience in recovery from orthopedic trauma. The level of resilience and its impact within the orthopedic trauma population merit further investigation.

Poster # 44

OPTIMAL TIMING FOR REPAIR OF PERIPHERAL NERVE INJURIES

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Introduction: Peripheral nerve injuries are debilitating for patients who survive severe trauma. Data regarding outcomes is limited, and the optimal management strategy for an acute injury is unclear. We aim to study clinical influences on motor-sensory outcomes and to review epidemiology and current management of peripheral nerve injuries.

Methods: Single center, retrospective study. Patients with traumatic peripheral nerve injury 01/2010 – 06/2015 were included. Exclusion criteria: mortality, amputation, brachial plexus injury, and missing motor-sensory exams. Motor-sensory exams were graded 0-5 by the Modified British Medical Research Council system. Operative repair of peripheral nerves was analyzed for the following variables: patient characteristics, anatomic nerve injured, level of injury, associated injuries, and operative characteristics (presence of “damage control surgery” (DCS), days until repair, and repair method).

Results: 311 patients met inclusion criteria. 258 (83%) patients underwent operative management, and 53 (17%) underwent non-operative management. Those who required operative intervention had significantly more penetrating injuries 85.7% vs 64.2% ($p<0.001$), worse initial motor scores 1.19 vs 2.23 ($p=0.004$), and worse initial sensory exam scores 1.75 vs 2.28 ($p=0.029$). Predictors of improved operative motor outcomes on univariate analysis were Injury Severity Score (ISS) <15 ($p=0.013$) and male sex ($p=0.006$). Upper arm level of injury was a predictor of poor outcome ($p=0.041$). Multivariate analysis confirmed male sex as a predictor of good motor outcome ($p=0.014$, AOR=3.88[1.28-11.80]). Univariate analysis identified distal forearm level of injury ($p=0.026$) and autograft repair ($p=0.048$) as predictors of poor sensory outcome. DCS ($p=0.257$) and days to nerve repair ($p=0.834$) did not influence motor-sensory outcome.

Conclusion: Influences on outcome in peripheral nerve repair included ISS, patient sex, and level of injury. Timing of repair did not impact clinical outcomes. Operative repair of peripheral nerve injuries can be performed after other life threatening injuries are addressed.

Poster # 45

PELVIC ANGIOEMBOLIZATION: HOW FAR DOWN THE RABBIT HOLE?

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Introduction: Blunt trauma leading to pelvic fractures and associated hemorrhage is a significant challenge. Interventional radiographic approaches to control pelvic bleeding have become the standard of care. One limitation of pelvic angiography is that it only identifies and treats the arterial injuries. When the angiogram is positive, a choice exists on non-selective embolization (NSE) of the internal iliac arteries versus selective embolization (SE) of distal branches. There is no clear standard on which type of embolization is best and what to do when the angiogram is negative. The purpose of this study was to define the risk profiles of non-selective embolization (NSE) versus selective embolization (SE). Secondarily, we sought to determine if prophylactic embolization in the face of a negative angiogram decreases blood transfusion requirements.

Methods: A multicenter retrospective review was conducted from three level one-trauma centers. The study population consisted of all blunt trauma patients with pelvic fractures who underwent angiography from January 2012 to December 2014. Exclusion criteria consisted of age less than 18. Demographic and clinical data was gathered from the trauma database and review of medical record after appropriate IRB approval. Inpatient embolization specific complications included wound infection or breakdown, gluteal or skin necrosis and osteomyelitis. Outpatient complications included claudication, sexual dysfunction, numbness, pain, urinary dysfunction, wound infection or breakdown, non-union or osteomyelitis. Thromboembolic complications included deep vein thrombosis or pulmonary embolism.

Results: One hundred ninety four patients made up the study population with a mean injury severity score of 26.33 and overall mortality of 19.6%. One hundred and forty five patients (75%) underwent embolization. Of the patients embolized, 68% (n=99) were a NSE and 32% (n=46) were SE. Both groups were equally matched in terms of age, ISS, pelvic abbreviated injury score, hemodynamic and physiological parameters. Length of procedure was significantly shorter in the NSE group (34.83+38.613 vs. 72.68+50.768, $p<0.001$). There was no significant difference in the rate of embolization specific complications between the two groups (4.0 % vs 4.3%, p=0.931). Thromboembolic events occurred significantly more often in the NSE group (12.1% vs 0, p =0.014). Sixty-seven patients had a negative angiogram. Twenty-six (39%) of those patients were prophylactically embolized. There was no significant differences in amount of blood transfused in the first twenty-four hours (3.4 +3.7 vs 5.3+8.3 units of packed red blood cells (PRBCs), p=0.277) blood transfused during the total hospital stay (6.7+5 vs 10.2+14 units of PRBCs, p=0.223), nor inpatient embolization related complications (3.8% vs. 14.6%, p=0.159) between patients prophylactically embolized and those who were not.

Conclusion: Our study confirms the lethal nature of pelvic fracture associated hemorrhage with a mortality of 19.6%. When the angiogram is negative, performing a prophylactic embolization does not significantly reduce blood loss. In those patients who have a positive angiogram, the decision to perform a NSE versus SE should be made based on hemodynamic stability. Time to control of hemorrhage is significantly shorter in NSE; however this comes at a potential cost of increased thromboembolic events.

Poster # 46

PARTIAL OCCLUSION STRATEGY WITH REBOA IS FEASIBLE AND SAFE COMPARED WITH FULL OCCLUSION TREATMENT FOR TRAUMATIC HEMORRHAGIC SHOCK PATIENTS

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Introduction: Recently, REBOA (resuscitative endovascular balloon occlusion of the aorta) has been entering in the limelight as one of the first-line procedures for a traumatic hemorrhagic shock patient. Some papers reported that REBOA was less invasive than resuscitative open aortic cross clamping and effective for critically hemorrhagic shock from pelvic fractures. On the other side, some studies pointed out that REBOA treatment was associated with a higher mortality. REBOA would be one of the temporal hemostatic methods that bridge to fundamental hemostasis. Then, is it possible trying to control hemorrhage as early as possible would do harm to a survival outcome? We made a hypothesis that one of the prognostic factors would be the strategy after doing REBOA. According to some case reports, continuous full occlusion of aorta over 45 minutes caused deadly complications but longer occlusion with partial volume were possible without severe ischemia. Then we studied the possibility of partial occlusion strategy as a REBOA to severe trauma.

Methods: Consecutive traumatic hemorrhagic shock patients who were undergone REBOA as a first-line resuscitative treatment at our emergency and trauma center, and whose hemodynamics were stabilized with doing REBOA and could get through a fundamental hemostasis by operative management and/or transcatheter arterial embolization were included. They were sorted into full occlusion treatment group (groupF) and partial occlusion treatment group (groupP). Group F were basically treated with keeping full occlusion but release the balloon pressure within every 30 minutes in order to avoid ischemic injuries. Group P were treated with permissive hypotension strategy (sBP>80mmHg) and tried to keep partial occlusion as long as possible. The primary end point was a survival rate at 30 days after injury. Secondary end points were fluid factors as total amount of bleeding, saline infusion and blood transfusion, and ischemic or reperfusion complications.

Results:43 trauma patients were treated with REBOA and 26 patients were succeeded in REBOA resuscitation and sorted into two groups (GroupF 15 patients and GroupP 11 patients). There were no significant differences in age (GroupF vs. GroupP : 45.8 vs 39.6), rate of blunt trauma (13/15 (87%) vs. 9/11 (82%)), ISS (38.2+/-14.1 vs. 43.8+/-15.2), initial sBP (46.6 vs. 58.2), initial shock index(2.3 vs. 2.4), any laboratory data. RTS was significantly lower in GroupF (3.52 vs. 5.65, p=0.02). Total duration of REBOA (65.8min vs. 72.1min) and maximum continued duration of occlusion (32.5min vs. 28.8min) were not different significantly, but duration of partial occlusion was much longer in GroupP (11.8min vs. 38.4min). There were no significant difference in any fluid factors and a survival rate (9/15 (60%) vs. 3/11 (27%)), and rate of complications (no organ ischemia, leg ischemia (0/15(0%) vs. 1/11(9%)), hyperkalemia (4/15 (27%) vs. 4/36 (36%)).

Conclusion: Partial occlusion treatment with REBOA did not increase any amount of bleeding, blood transfusion, complications and mortality rate compared with full occlusion treatment. Then it would be a feasible and safe as a REBOA treatment.

Poster # 47

TIME TO AORTIC OCCLUSION: IT'S ALL ABOUT ACCESS

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Introduction: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a less invasive method of proximal aortic occlusion compared to resuscitative thoracotomy with aortic cross-clamping (RTACC). The aim of this study was to compare time to aortic occlusion with REBOA and RTACC, both including and excluding time required for CFA cannulation.

Methods: Patients receiving REBOA or RTACC performed between Feb 2013 and Jan 2016 captured on real-time videography were included. Timing of all procedural steps was collected: initial skin incision to aortic cross-clamp for the RTACC group, time from guide-wire insertion to balloon inflation at Zone 1 (just above diaphragm) for the REBOA group, and length of time required for CFA cannulation prior to REBOA. Time to common femoral artery (CFA) cannulation for REBOA by percutaneous or open methods was also compared.

Results: During the study period, 18 RTACC and 21 REBOAs were performed. There was no significant difference in age or gender between the two groups. There was no significant difference in procedure times between the 8 clamshell and 10 left side-only thoracotomies (376±188s vs. 361±144s; p = 0.85). Mean time from initial skin incision to aortic cross clamping in the RTACC group was 370- +165 seconds, while mean time from start of arterial access to Zone 1 balloon occlusion was 492+/-107s (vs. RTACC, p=0.0084). All REBOA procedures were performed with the same device which requires a guidewire platform and large arterial sheath. The mean time to complete CFA cannulation was 252+/-112s, with no difference between percutaneous or open procedures access (p = 0.74). The mean time to aortic occlusion in REBOA once arterial access had been established was 240+/- 81s, which was significantly shorter than RTACC (p = 0.0031). There was no difference in mortality between RTACC and REBOA. Trainees performed the procedures in 3 cases (14%) for REBOA and 2 cases (11%) for RTACC.

Conclusion: Time to aortic occlusion, once CFA is achieved, is faster with REBOA, emphasizing the importance of rapid and accurate CFA access. Time to aortic occlusion is also less than the time required to cannulate the CFA either by percutaneous or open approaches. REBOA may represent a feasible alternative to thoracotomy for aortic occlusion in the hands of physicians who are highly skilled at arterial access procedures. Time to aortic occlusion once CFA is achieved will likely decrease with the advent of newer technology that eliminates the need for a long guidewire platform. The rate-limiting and longest portion of the REBOA will continue to be obtaining CFA access.

Poster # 48

VITAMIN D BINDING PROTEIN (DBP) DEFICIENCY INDUCES A REPARATIVE SYSTEMIC CYTOKINE PROFILE FOLLOWING ACUTE MUSCLE INJURY

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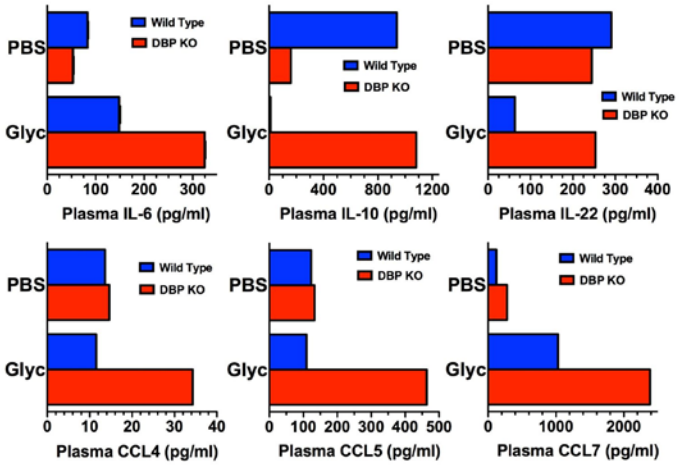
Introduction Severe trauma results in massive cell damage and death at the site of injury causing the release of intracellular contents into extracellular fluids. This results in the release of intracellular actin, which complexes with DBP in the blood and extracellular fluid. DBP-actin complexes are among the earliest markers of tissue damage However, the effects of these complexes on systemic cytokine levels is not known.

Methods Ten-week old C57BL/6 wild-type (DBP+/+) and DBP deficient (DBP-/-) mice, received intramuscular (i.m.) injections of either 50% glycerol or phosphate-buffered saline (PBS) into the thigh muscles. Muscle injury was assessed on H&E stained slides. Select cytokine levels were examined in pooled plasma samples using a multiplex ELISA (n=8 per group).

Results All animals survived the procedure. Harvested thigh muscles from the side of injection in glycerol treated wild-type and DBP-/- mice demonstrated disruption and lysis of skeletal myocytes and an inflammatory cell infiltrate. At 48 hours following i.m. glycerol injection, DBP-/- mice had higher pooled plasma levels of IL-6 (2x), IL-10 (10x) and IL-22 (5x), and CCL4 (3x), CCL5 (4x), and CCL7 (2x) than wild-type mice (see figure). PBS injection demonstrated systemic cytokine alterations that were relatively comparable to those in DBP-/- mice, with the exception of IL-10.



Conclusion: Glycerol induced acute muscle injury triggered a systemic pro-inflammatory response as noted by marked increases in IL-6 in both wild-type and DBP-/- mice. Mice with a systemic DBP deficiency (DBP-/-), and therefore lacking the ability to generate DBP-actin complexes, demonstrated a change in their cytokine profile 48 hours after injury to a more anti-inflammatory (higher levels of IL-10 and IL-22) and pro-resolution/reparative phenotype (higher levels of CCL4, CCL5, CCL7).

Poster # 49

THE TRAUMA CENTER IS TOO LATE: SEVERE EXTREMITY INJURIES WITHOUT A PRE-HOSPITAL TOURNIQUET HAVE INCREASED DEATH FROM HEMORRHAGE

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Introduction: The US military recommends early prehospital (PH) placement of extremity tourniquets as a means of rapid, effective and lifesaving hemorrhage control. The Hartford Consensus encourages the use of PH tourniquets to prevent exsanguination from extremity injuries. However, other groups have held off making similar recommendations, largely because of concerns that the pattern and rate of severe extremity injury seen in civilian trauma centers does not justify widespread use of PH tourniquets. Based on the compelling military data, we placed PH tourniquets into use in 2008. We hypothesized that trauma center (TC) tourniquet use would increase hemorrhage-related death compared to PH placement.

Methods: This was a retrospective study of all patients arriving to a Level-1, urban TC between 10/2008 and 01/2016 with a tourniquet placed prior to (T-PH) or after arrival to the TC (T-TC). Cases were assigned the following designations: *absolute* indication (operation within 2 hours for extremity injury, vascular injury requiring repair/ligation, or traumatic amputation), *relative* indication (major musculoskeletal/soft-tissue injury requiring operation >2 hours after arrival, documented large blood loss), *non-indicated*. Patients with *absolute* or *relative* indications were designated as *indicated*. Outcome included hemorrhage-related death. Continuous values are expressed as median (IQR) and comparisons between groups were performed using the Wilcoxon rank-sum test. Categorical values are expressed as proportions and tested for significance using chi-squared or Fisher's exact tests. Following univariate analysis, logistic regression was carried out to assess independent predictors of hemorrhage-related mortality.

Results: 306 patients received 326 tourniquets for injuries to 157 upper and 147 lower extremities. 278 (91%) had an indication for placement, 249 T-PH and 29 T-TC. Reasons for T-TC placement included active extremity bleeding with hypotension (56%), without hypotension (26%), ACLS in progress (11%), and unknown (7%). Demographic, TC physiologic/laboratory, and injury data for the two groups is displayed in the TABLE. Rates of arterial injury (39%, p=0.9), amputation (25%, p=0.2) and compartment syndrome (1.8%, p=0.4) were equivalent. Hemorrhage-related death was significantly greater in the T-TC group (13.8% vs. 2.4%, p=0.01). When controlling for year of admission, mechanism of injury, arrival physiology and shock (base deficit), patients who had their tourniquet placed at the TC had an 8.5-fold increased odds of hemorrhage-related mortality compared to those who had theirs placed in PH setting [OR 8.5 95% CI 1.1-68.9, p=0.04].

	T-PH (n = 249)	T-TC (n = 29)	*p* value
Age (years)	33 (25, 46)	33 (25, 46)	0.97
Male (%)	83.53	93.1	0.17
Caucasian (%)	46.99	44.83	0.83
Blunt (%)	71.49	62.07	0.29
Air Transport (%)	63.45	48.28	0.11
ISS	9 (5, 17)	20 (9, 27)	**<0.01**
ΔSBP (mmHg)	1 (-12, 28)	-10 (-22, 3)	**<0.05**
Shock Index	0.79 (0.6, 1.09)	1.13 (0.74, 1.53)	**<0.01**
Base Excess	-4 (-7, -1)	-6 (-12, -1)	0.23
Death-all cause (%)	4.02	13.79	**<0.01**

TABLE

Conclusion: PH tourniquet use in civilians that sustained severe extremity injuries was associated with improved physiologic parameters upon TC arrival and no difference in complications. Delaying tourniquet application until TC arrival is associated with greater than 8-fold increased odds of hemorrhage-related mortality.

Poster # 50

NON-FATAL MOTORCYCLE CRASHES: AN OPPORTUNITY TO TEACH SAFETY

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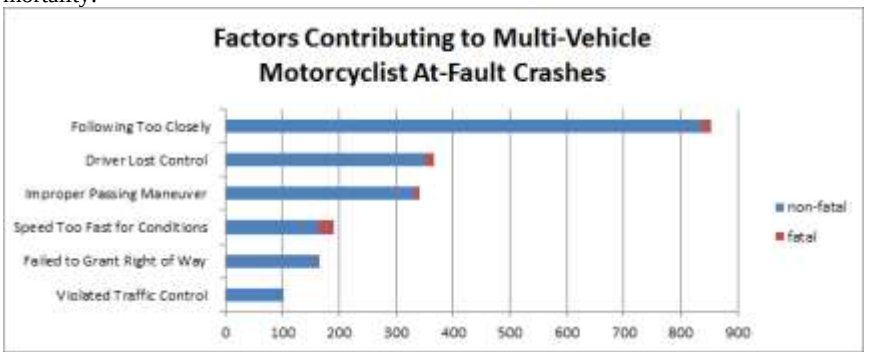
Introduction: While motorcycle riders have a significant risk of death when involved in a crash, many survive. Alcohol impairs motorcycle driving ability, even at blood alcohol levels as low as 0.02%. Drivers and passengers who have been involved in crashes while impaired are at risk for driving impaired in the future. Hospitalization decreases law enforcement's identification of drivers impaired by drugs and alcohol. We sought to analyze motorcyclists who were involved in crashes and determine rates of intoxication as identified in the Connecticut Crash Repository.

Methods: Data for all crashes that involved motorcycles between 2009 and 2014 was downloaded from the Connecticut Crash Repository. The data was analyzed using R (R Foundation for Statistical Computing, Vienna, Austria).

Results: Between 2009 and 2014, there were a total of 8501 crashes involving 9439 motorcycle riders. Three percent (321/9439) of the riders were fatally injured. In 37% (3175/8501) of the crashes, only a single motorcycle and no other vehicle was involved. Of the 5326 crashes involving multiple vehicles, the motorcyclist was found to be at fault 44% (2363/5326) of the time and "following too closely" was the most common factor, contributing to 36% (853/2363) of these crashes. Overall, 57% (5350/9439) of motorcyclists were not wearing a helmet. Similarly, 57% (5157/9118) of the motorcycle riders who survived after a crash were not wearing helmets.

The motorcycle driver was recorded to be intoxicated with drugs or alcohol in 31% (98/321) of the fatal crashes vs 2% (202/9118) of the non-fatal crashes ($p < 0.0001$). Of fatal crashes involving only a single motorcycle, the motorcycle driver was intoxicated 42% (57/80) of the time vs 22% (41/143) of multi-vehicle fatal crashes ($p < 0.001$).

Conclusion: While a majority of intoxicated motorcycle crash victims survive, this leaves them at risk for recidivism. The data suggest that drugs and/or alcohol are a factor in a significant percent of fatal motorcycle crashes and so, motorcyclists at risk for impaired driving must be identified. Efforts to improve safe motorcycle riding such as substance abuse counseling, defensive driving and education about motorcycle helmets could then be focused on this at-risk population and potentially decrease mortality.



Poster # 51

Mild Traumatic Brain Injuries Can Be Safely Managed Without Neurosurgical Consultation: The end of a neurosurgical "Nonsult"?

Jeffry T. Nahmias MD, Andrew Doben* MD, Eleanor S. Winston MD, Thomas Kaye MD, Michael G. DeBusk MD, Reginald Alouidor MD, Lisa Patterson* MD, Ronald Gross* MD, Baystate Medical Center

Introduction: In 2010, 2.5 million people sustained a traumatic brain injury (TBI), with an estimated 75% being mild TBI. Mild TBI is defined as a Glasgow Coma Scale (GCS) of 13-15. Recent data and our own institutional experience have shown that these patients may be safely managed without neurosurgical consultation. The aim of this study is to prospectively determine the safety of this practice.

Methods: All trauma patients admitted to a single Level I trauma center from June 2014 through July 2015 age 18 or older were evaluated. Those patients with a GCS >14, regardless of intoxication, with an epidural or subdural hematoma <4mm, trace or small subarachnoid hemorrhage (SAH), and/or non-displaced skull fracture were eligible for enrollment. Exclusion criteria included patients on any anticoagulant or antiplatelet agent except aspirin, regardless of dosage. Patients were prospectively followed for the primary outcome of need for neurosurgical intervention. Secondary outcomes included need for neurosurgical consultation, readmission rate, and mortality rate at 30 days post discharge.

Results: Of 1341 trauma admits, 77 patients met inclusion criteria. The mean patient age was 55.2 years and the mean Injury Severity Score was 15.6. Outpatient follow-up was achieved with 75/77 (97.4%) patients. No patients required neurosurgical intervention. Only 1/75 (1.3%) required neurosurgical consultation. The direct healthcare savings from avoiding consultation was $16,129.48. No mortalities were observed. The majority of patients (62.3%) were admitted to the floor with a mean overall length of stay of 2 days. No patient required re-admission and there was no major neurologic morbidity in any patient. A subset analysis of 21 patients on aspirin demonstrated no patients requiring neurosurgical intervention and only 1/21 (4.8%) receiving neurosurgical consultation with no mortalities observed at follow-up.

Initial Head CT Scan

Characteristics n (%)	n=77*
Subarachnoid Hemorrhage	47 (61%)
Subdural Hematoma	33 (42.9%)
Size, mean (sd)	2.8 (1.0)
Intraparenchymal Hemorrhage	12 (15.6%)
Size, mean (sd)	3.1, (0.9)
Skull Fracture	11 (14.3%)
Epidural Hematoma	0 (0%)

Note: size measured in mm
*103 injuries in 77 patients

Table 4. Patient Outcomes

Characteristics n (%)	n=77
Mortality	0 (0%)
Neurosurgical Management	
Intervention	0 (0%)
Consult	1 (1.3%)
Morbidity	
Major neurologic	0 (0%)
Concussion symptoms	12 (16%)
Length of Stay, mean (sd), range	2 (1.8), 0-9
Admission Location	
Floor	48 (62.3%)
NIU	25 (32.5%)
SICU	4 (5.2%)
Disposition of Discharge	
Home	64 (83.1%)
Rehab/Post-acute facility	13 (16.9%)
Return to ER, n (%)	2 (2.6%)
Re-admissions, n (%)	0 (0%)

*Note: 2 patients were unavailable for follow-up
Length of stay measured in days

Patients taking Aspirin

Characteristics n (%)	n=21 (27 injuries)
Mortality	0 (0%)
Neurosurgical Management	
Intervention	0 (0%)
Consult	1 (4.8%)
Morbidity	
Major neurologic	0 (0%)
Concussion symptoms	2 (9.5%)
Length of Stay, mean (sd), range	2.9 (2.1), 1-9
Admission Location	
Floor	11 (50.0%)
NIU	8 (38.1%)
SICU	2 (9.5%)
Disposition of Discharge	
Home	13 (61.9%)
Rehab/Post-acute facility	8 (38.1%)
Return to ER	0 (0%)
Re-admissions	0 (0%)

Note: 1 patient was unavailable for follow-up

Conclusion: The management of patients with a GCS >14 and SDH/IPH < 4mm, small subarachnoid hemorrhage, and non-displaced skull fracture can be safely accomplished by trauma/acute care surgeons without neurosurgical consultation and is associated with both financial and resource savings. Future larger prospective studies regarding patients on aspirin must be undertaken to ascertain if these patients can be safely managed without neurosurgical consultation.

Poster # 52

CORRECTION OF PLATELET DYSFUNCTION IN PATIENTS WITH TRAUMATIC BRAIN INJURY

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Introduction: Platelet adenosine diphosphate (ADP) inhibition is a known contributor to coagulopathy in traumatic brain injury (TBI). We hypothesized that platelet transfusion could reverse the ADP receptor inhibition in patients following TBI.
Methods: Patients admitted with TBI to our level I trauma center (April 2015 – November 2015) were retrospectively reviewed. Platelet mapping thromboelastography (PM-TEG) was obtained in patients with GCS < 13. Patients with ADP inhibition (> 60% inhibition) were transfused platelets (1 apheresis unit). Repeat PM-TEG and transfusion was completed until inhibition was corrected (<60% ADP inhibition) (maximum 3 units).
Results: 79 patients were included, 67.1% male (n=53), 32.9% female (n=26), age = 50.3 ± 22.4 years. Most common injury mechanisms were fall (32.9%), motor vehicle collision (25.3%), pedestrian struck (12.6%). Initial GCS = 7.31 ± 4.8, Injury Severity Score (ISS) = 23.5 ± 11.8. Injuries included subdural hematoma (58.2%), subarachnoid hemorrhage (55.7%), intraparenchymal hemorrhage/contusion (44.3%) and epidural hematoma (6.3%). Neurosurgical intervention (decompressive craniectomy or intracranial pressure monitor) occurred in 45.5%. Use of pre-injury antiplatelet therapy (clopidogrel, ASA) was present in 29.1% (n=23) of patients. Overall mortality was 35.4% (36.1% in inhibited patients, 25.1% in uninhibited patients). Mean ADP inhibition for all patients weas 67.9%. Of the 47 (59.4%) patients with ADP inhibition, 19 completed the protocol. Reasons for not completing protocol included lack of patient availability (OR, radiology), delay in availability of TEG data, patient death and misinterpretation of data in the EMR. Sixteen of the 19 (85%) corrected with platelet transfusion (10 after 1 unit, 5 after 2 units, 1 after 3 units; average 1.4 units). One of the 3 patients who did not correct died.
Conclusion: Platelet receptor inhibition can be reversed following platelet transfusion to correct coagulopathy in traumatic brain injury.

Poster # 53

DOES EARLY BETA-BLOCKADE IN TRAUMATIC BRAIN INJURY REDUCE THE RISK OF POST TRAUMATIC DEPRESSION?

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Introduction: Depression occurs in up to half of trauma patients and negatively impacts on functional outcome and quality of life. Pontine noradrenaline has been shown to increase upon trauma and associated β-adrenergic receptor activation appears to consolidate memory formation of traumatic events. Blocking adrenergic activity reduces physiological stress response during recall of traumatic memories and impairs memory recollection. This implies a potential therapeutic role of β-blockers in these instances. We set out to examine the effect of pre-admission β-blockade on post-traumatic depression.

Methods: All adult trauma patients (≥18 years) with severe isolated traumatic brain injury (intracranial AIS ≥3 and extracranial AIS<3) were recruited from the trauma registry of an urban university hospital between 2007-2011. Exclusion criteria included in-hospital deaths and patients prescribed anti-depressants up to one year prior to admission. Pre- and post-admission β-blocker and anti-depressant therapy data was requested from the national drugs registry. "Post-traumatic depression" was defined as prescription of anti-depressants within one year of trauma. Patients with and without pre-admission β-blockers were matched 1:1 by age, gender, Glasgow Coma Scale, Injury Severity Score, Intracranial Abbreviated Injury Scale (AIS) score. Analyses were carried out using McNemar's and Student's t-test for categorical and continuous data, respectively.

Results: Overall, a total of 545 patients met the study criteria. Of these, 14.7% (n=80) was prescribed β-blockers pre-admission. After propensity matching, 80 matched pairs were analyzed. 32.5% (n=26) of non β-blocked patients developed post-traumatic depression while this reduced to only 17.5% (n=14) in the β-blocked group (p=0.04). There was no significant difference in ICU (mean days: 5 ±7 vs. 6 ±11, p=0.5) or hospital length of stay (mean days: 20 ±22 vs. 21 ±21, p=0.8) between the cohorts.

Conclusion: Pre-admission β-blockade appears to act prophylactically, and significantly reduces the risk of post-traumatic depression.

Poster # 54

THROMBOEMBOLISM FOLLOWING CESSATION OF WARFARIN CHEMOPROPHYLAXIS FOR ATRIAL FIBRILLATION (AF) IN PATIENTS WHO SUSTAINED MILD TO MODERATE TRAUMATIC BRAIN INJURY (TBI)

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Introduction: In patients with TBI, the safe interval between systemic AC reversal with its risk of embolic stroke, and AC restart with possible CNS rebleeding has not been established. The thromboembolic outcome of AF patients is examined in this study.

Methods: 103 patients taking warfarin for AF who had sustained a non-penetrating moderate TBI between January 1, 2010 and January 1, 2015 were assessed by review of their electronic medical record (EMR) all CT imaging for a period of 6-months post injury. Demographics, comorbidities, mechanism of injury, admission INR, GCS, CHA2DS2-VASc scores, date and type of INR reversal drugs used, and date and nature of any thromboembolic events were recorded. All patients underwent repeat CT imaging within 24 hours of injury, and after re-initiation of systemic AC. Prophylactic AC for DVT was started within 3-5 days of TBI.

Results: The mean age was 77.6 ± 10.6 years. Admission INR was 2.8 ± 1.2. The CHA2DS2-VASc score was 4.2 ±1.7. Warfarin was reversed within 12 hours in 97 patients using vitamin K/fresh frozen plasma (FFP) in 47 patients, or with prothrombin complex concentrate (PCC)/vitamin K in 50 patients. Ninety-eight patients survived to hospital discharge and 5 patients died. Eighty-eight patients were discharged to home or to a neuro-rehabilitation center. Ten patients were discharged to a chronic nursing facility or Hospice. The average hospital length of stay (LOS) was 7.9 ± 7.7 days. Warfarin or a substitute (eg. Plavix) was restarted in 41 patients 2 -106 days following its reversal (mean 27.9 ± 34.3 days). None rebled. Warfarin was not restarted in 62 patients due to a history of repeated falls, in-hospital death or excessive risk. Fourteen patients sustained thromboembolism 2 - 100 days following reversal of anticoagulation (mean 19.9 ± 35.1 days). There were three DVT/PE's and eleven cerebrovascular events. Of the fourteen occurrences, twelve had their onset within 17 days of warfarin reversal which was equally divided between FFP/vitamin K and PCC/vitamin K. Re-initiation of systemic AC in the 14 thromboembolic patients occurred 27.6 ± 25.2 days following TBI and warfarin reversal. The admission INR (2.9 ± 1.5) and the CHA 2DS2-VASc score (4.2 ± 2.2) of the 14 was the same as those without these events.

Conclusions: In this study, the cerebrovascular event rate was high and occurred early following injury and AC reversal. Strategies for earlier resumption of AC in patients with stable CT imaging and no contraindication should be encouraged.

Poster # 55

THE GERIATRIC TRAUMATIC BRAIN INJURY ON ASPIRIN: DOES PLATELET TRANSFUSION MATTER?

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Introduction: Platelet transfusion is increasingly utilized in patients with traumatic intracranial hemorrhage (ICH) who are on aspirin or clopidogrel to minimize progression of intracranial bleeding. Currently, there is no defined standard of care specifically regarding the management of platelet induced dysfunction from antiplatelet agents in this population. Our hypothesis is that platelet transfusion in this cohort of patients does not affect platelet function or impact bleed progression.

Methods: This is a prospective interventional trial enrolling patients on daily aspirin with traumatic ICH diagnosed by brain computed tomography (CT). All patients received 1 pack of apheresis platelets within 2 hours of injury. Platelet function was assessed utilizing Verify Now Assay® on blood samples collected before and then one hour after platelet transfusion. The cutoff for functioning platelets was defined as $\geq$ 550 standardized Aspirin Reaction Units (ARU).

Results: A total of 34 patients were enrolled with a mean age of 80.5 (range, 54-97), 65% female, median Glasgow Coma Scale (GCS) score of 15 (range, 9-15), and median head Abbreviated Injury Score (h-AIS) of 3 (range, 2-5). After platelet transfusion, 14 of 34 (41%, 95% CI 25-59%) patients responded by converting to functional platelet status by ARU measurement. Progression of ICH occurred in 14 out of 34 (41%, 95% CI 25-59%) of patients. There was no association between responder status and ICH progression (7 out of 14 of non responders vs 7 out of 20 of responders, p=0.4). In addition, pre-transfusion ARU, ARU difference (posttransfusion-pretransfusion ARU), dual platelet therapy with clopidogrel, admission platelet count and GCS were also not associated with ICH progression on repeat brain CT. Only h-AIS was associated with ICH progression (median 4 vs 3, p=0.04).

Conclusion: Progression of traumatic ICH occurred commonly in patients with dysfunctional platelet function secondary to preinjury antiplatelet therapy as measured by the Verify Now Assay® despite platelet transfusion. Reversal of platelet dysfunction as measured by ARU was not associated with stability of the initial ICH. Further randomized trials are needed to evaluate the utility of platelet transfusion in this subset of patients.

Poster # 56

PLASMA OF SUBARACHNOID HEMORRHAGE AND REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME PATIENTS INCREASES BRAIN ENDOTHELIAL PERMEABILITY IN VITRO

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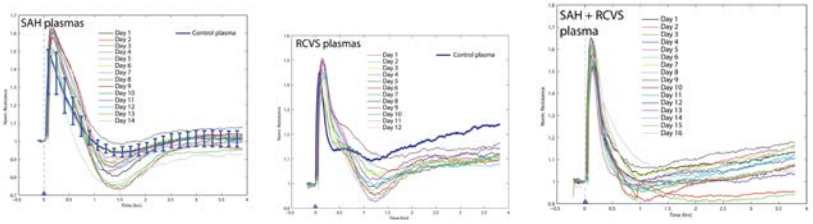
Swedish Medical Center

Introduction: Traumatic injury is a leading cause of Subarachnoid Hemorrhage (SAH) and has been associated with cerebral vasospasm. The prognosis after SAH is poor. Reversible Cerebral Vasoconstriction Syndrome (RCVS) is another condition associated with cerebral vasospasm; the prognosis for most patients with RCVS is good, but some may experience permanent deficits due to hemorrhage or ischemic stroke. The underlying pathophysiology and predictors of these complications remain unknown. The aim of this investigations was to evaluate the ability of SAH and RCVS patient plasma to alter endothelial permeability.

Methods: Heparinized plasma was obtained from admitted patients with SAH or RCVS at a Level 1 trauma center. Primary human brain endothelial cells were then grown on impedance sensing chambers under standard culturing conditions. When functional barrier was achieved, the cells were challenged with sterile filtered plasma samples and trans-endothelial resistance was measured for 24 hours.

Results: During the course of stay, temporal changes in SAH and RCVS patient plasma were observed that altered brain endothelial barrier function *in vitro*. These fluctuations in vascular permeability proved dynamic, with periods of recovery followed by drops in resistance across the monolayers that correspond with increased permeability.

Conclusion: Systemic factors exist in the plasma of these patients that can increase permeability of cultured brain endothelial cells. These findings represent a first attempt to understand the pathology as well as aid in the surveillance and intervention of debilitating events. Elucidation of the factors driving the changes in permeability seen in these assays may help identify predictive markers for cerebral vasospasm and vascular leak.



Poster # 57

Early volume changes in hippocampus area demonstrated using VSRAD program appears to be advantage for clinical acute care physicians to predict the reduction of daily activity following moderate head trauma

Junya Tsurukiri MD, Ph.D., Shigeki Sunaga MD, Ph.D., Jun Oda* MD, Ph.D., Tetsuo Yukioka* MD, Ph.D., Tokyo Medical University

Introduction: The objective evaluation of the changes in volume of hippocampus area (VOH) following traumatic brain injury (TBI) can be demanding for acute care physicians. This study aimed to investigate the relation of VOH changes in acute phase and the relation of daily activity following moderate TBI using the voxel-based specific regional analysis system for Alzheimer's disease (VSRAD) advance program.

Methods: After obtaining appropriate approval from the institutional committee, a retrospective study of patients with moderate TBI over a period of 1.5 years was carried out. Moderate TBI defined as Glasgow Coma Scale (GCS) score of 8-12. Patients aged ≤12 years or those with GCS score < 8 were excluded. Three-dimensional FLAIR sagittal magnetic resonance imaging (MRI) evaluation was carried out within 3 days as control, and at 10 days and 30 days after injury in each patient. VSRAD program is designed to evaluate the VOH from the visual information by MRI, and to compare the brain image database between individual patients and healthy volunteers (control) using voxel-based morphometry (*Z score*).

Z score = {[Control mean] – [individual value]} / Control SD

We used the VSRAD program to analyze the data from MRI images and assess the degree of VOH. Neurological outcome was evaluated at 3 months after injury using modified Rankin Scale (mRS) score.

The degree of volume of hippocampus changes (Z core)	
0 ~ 1	No reduction
1 ~ 2	Mild reduction
2 ~ 3	Moderate reduction
3 ≤	Severe reduction
Z score = {[Control mean] - [individual mean]} / Control SD	

Results: This study comprised 26 patients who had moderate TBI with a mean age of 68 years and initial GCS score of 12. All of patients lived independently before injury. The most common type of injury was brain contusion at frontal lobe. The reduction of daily activity at 3 months after injury were determined in 8 patients with mRS 4-5 and a median *Z score* within 3 days was 2.5 (interquartile range, 1.9-4.5). The severity of VOH changes at 10 days compared with that within 3 days in patients with impaired daily activity was significantly higher than that in patients with normal activity. (Table) Intractable epilepsy after injury was determined in 1 patient with impaired daily activity.

	Patients with moderate TBI	
Characteristics	Reduction of daily activity (+)	Reduction of daily activity (−)
Patients, n	8	18
Appearance of brain contusion, n (%)	6 (75)	14 (78)
Z score within 3 days after injury	2.5 (1.9 - 4.5)*	1.4 (0.9 - 2.1)
Severity of VOH changes		
Z score 10 days / Z score <3days	1.1 (1.0 - 1.2)*	0.9 (0.7 - 1.0)
Z score 30 days / Z score <3days	1.1 (1.0 - 1.1)	0.8 (0.8 - 1.0)

TBI, traumatic brain injury; VOH, volume of hippocampus

Conclusion: VSRAD advance program appears to be significantly advantage for acute care physicians to evaluate the early changes in volume of hippocampus area. Further, appearance of acute reduction of VOH suggests the reduction of daily activity and may require earlier rehabilitation.

Poster # 58

MORTALITY FROM COMBAT-RELATED TRAUMATIC BRAIN INJURY (TBI) IS BEST PREDICTED BY THE MILITARY INJURY SEVERITY SCORE (mISS)

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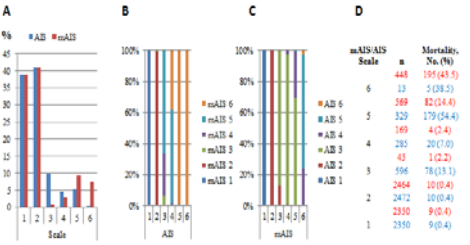
Introduction: Traumatic injuries to the head/neck have been higher during combat operations in this century (30%) than they were compared to the Vietnam War (16%) and World War II (21%). The recent wars in the Middle East have resulted in this higher rate of traumatic brain injury (TBI) secondary to increased exposure to explosive injuries resulting from improvised explosive devices (IEDs), mortar, mines and rocket-propelled grenades. The severity of TBI secondary to these mechanisms can be difficult to assess using accepted standards such as Injury Severity Score (ISS) and Glasgow Coma Scale (GCS); therefore, prognostication in this patient population can be a challenge. Our group has previously validated the military injury scoring system (mAIS and mISS). In this study we evaluated the mISS as a potentially better predictor of mortality for combat-related traumatic brain injury.

Methods: A retrospective analysis was conducted. Data from the DoD Trauma Registry was extracted from 1/2003 to 12/ 2014. Inclusion criteria were: U.S. service members wounded in OEF or OIF; presence of TBI defined by ICD-9 codes; had both AIS and mAIS data; and no evidence of other major injury (AIS≤2 or mAIS ≤2 for the other body regions). The mISS and ISS were calculated by the sum of the squares of the three highest mAIS scores using the AIS-2005 Military criteria (mAIS) for mISS and AIS-2005 criteria (AIS) for ISS, respectively. The primary outcome measure was mortality. Descriptive analyses were performed with the Mann-Whitney, t-test and Chi-square tests where appropriate. Logistic regression was used to calculate the likelihood of mortality associated with level of mISS and ISS in military TBI population. Area under the ROC curve (AUROC) and Hosmer-Lemeshow test were used compare mISS and ISS.



Results: 6045 TBI patients were analyzed with 97.3% male and a mean (±SD) age of 25.8 (±6.3). Mean head/neck mAIS and AIS were similar, 2.3 (±1.6) and 2.0 (±1.1), respectively, but AIS scales were shifted ≥1 scales in the mAIS scale. Severe TBI patients with mAIS of 5 and 6 included mild TBI patients categorized in AIS of 1-4 as seen in Panel A-C. Overall difference between the mean of mISS and ISS were small, 12.5 and 7.5; however, discordant scores between mISS and ISS was 19.4%, accounting for 90.7% deaths. Mortality rate was 5.0% (n=301) with a disproportional death rate in AIS scales of 3, 4, and 5 compared to the mAIS, 13.1 vs. 2.2, 7.0 vs. 2.4 and 54.4 vs. 14.4, respectively (Panel D). AUROC was 0.91 (0.89-0.93) for mISS and 0.88 (0.86-0.91) for ISS.

Conclusion: mAIS improves accuracy for diagnosis of TBI in the combat casualty population; additionally, mISS is a better predictor of mortality from brain injury.

Poster # 59

TRAUMATIC BRAIN INJURY ALTERS THE GASTROINTESTINAL MICROBIOME

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Background: Traumatic brain injury (TBI) is a leading cause of death in both children and adults with over 1 million cases a year. The microbiome is defined as the collective genomes of the microbes (composed of bacteria, bacteriophage, fungi, protozoa and viruses) that colonize the human body and has been associated with a number of disease states. Systemic insults such as trauma, burn or TBI, elict an inflammatory response that may alter the gastrointestinal (GI) microbiome. Changes in the gut commensals can influence the neurologic system via the brain-gut axis, further affecting outcomes. The objective of this study was to evaluate the GI microbiome in a pre-clinical TBI cortical impact model.

Methods: Sprague Dawley rats (300-400g; n = 10) were anesthetized, placed in a stereotaxic frame, and then underwent a 6mm craniotomy exposing the dura matter. The dura was then impacted directly using a pneumatic impactor. Fecal samples were collected at the following time points: pre-TBI, 2 hrs and 1, 3, and 7 days after injury. DNA was purified from all fecal samples and the 16s rRNA gene was amplified using PCR. Amplicons were sequenced using the Illumina MiSeq Sequencer to characterize the microbiome at each time point. Bacterial diversity analysis and taxonomic classification according to organizational taxonomic units (OTUs; 97% sequence similarity) were performed. Beta-diversity was calculated and STAMP software was used to analyze all data. Analysis of variance was used to make comparisons between time points.

Results: Prior to TBI, GI microbial diversity was similar among the rats. Significant changes in the GI microbiome were evident as early as 2 hrs after TBI as compared to pre-injured samples, with varying trends among the phylogenetic families. There was an initial decrease in OTUs seen in the families of Anaeroplasmataceae, Lachnospiraceae and Verrucomicrobiaceae at 2 hrs with the Lachnospiraceae and Verrucomicrobiaceae returning to baseline levels by 7 days (p values all <0.05). Bacteroidaceae, Enterobacteriaceae, Mogibacteriaceae and Pseudomonadaceae all demonstrated increased levels by 3 days post-TBI with all levels in these families returning to baseline levels by 7 days (p values all <0.05).

Conclusions: The gastrointestinal microbiome is altered in rats subjected to a TBI as early as 2 hrs post-injury in the absence of resuscitation, antibiotics, and analgesics. Changes in the microbiome may represent a novel biomarker to stage TBI severity and predict functional outcome.

Poster # 60

THE IMPACT OF A MULTIMODALITY MONITORING AND GOAL-DIRECTED THERAPY PROTOCOL ON THE OUTCOME OF PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY: A 5-YEAR SINGLE INSTITUTIONAL EXPERIENCE

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Introduction: Patients with severe traumatic brain injury (sTBI) defined by a Glasgow Coma Scale (GCS) ≤ 8 continue to be treated according to the Brain Trauma Foundation guidelines. On-going controversy remains regarding whether a multimodality monitoring and goal-directed therapy protocol may decrease the mortality of patients with sTBI. This study investigates the impact of a goal-directed multimodality monitoring and therapy protocol (MM&GDTP) on the mortality of patients with sTBI compared to the 14-day mortality predicted by the CrasH model.

Methods: retrospective review of 536 sTBI patients (1/1/2011 to 12/31/2015) with a mean age 50 ± 23, a median GCS 3 (3, 6) who were monitored and treated with a MM&GDTP that included maintenance of normothermia with dry water immersion, brain O2 (PbO2) ≥ 20 mm Hg, ICP ≤ 20 mm Hg, cerebral perfusion pressure (CPP) ≥ 60 mm Hg to keep tissue oxygen saturation (bi-frontal Near-Infrared Spectroscopy- NIRS) ≥ 60%, burst suppression as needed, nutritional support targeted to a Respiratory Quotient (RQ) of 0.83 by day 3, osmotherapy and decompressive craniectomy (DC) when indicated. Data acquired included age, sex, GCS, injury severity score (ISS), Abbreviated Injury Scale Head (AIS-H), CPP, PbO 2, NIRS values, RQ value, nitrogen balance, and mortality. Data, presented as means ± SD and median with IQR, were analyzed with univariate and stepwise logistic regression analysis.

Results: 156/536 (29.1%) patients required DC. The predictive mortality (PM) was 69 ± 19 whereas actual mortality was 168/536 (31.3%), yielding a reduction in mortality ranging from 37% to 54%. There was no difference in the mortality of patients requiring DC as opposed to those who did not require it, 40/156 (25.6%) vs. 128/380 (33.6%), respectively, p=0.91. In the stepwise logistic regression analysis, increasing age, higher AIS-H and the need for craniotomy were risk factors for increased mortality.

Variable	All patients (n=536)	Survivors (n=368)	Non-Survivors (n=168)	P Value
Age	50 ± 23	45 ± 22	61 ± 18	0.001
GCS	3 (3, 4)	3 (3, 6)	3 (3, 3.25)	0.01
ISS	26 ± 12	24 ± 13	31 ± 11	0.001
AIS-H	4 ± 1	4 ± 1	5 ± 1	0.001
CrasH PM	69 ± 19	62 ± 16	82 ± 16	0.001

Conclusion: Based on our 5-year institutional experience, we conclude that a MM&GDTP targeted to specific endpoints can decrease mortality in patients with sTBI.

Poster # 61

THE SATISFIED TRAUMA PATIENT? ANALYSIS OF HCAHPS SCORES IN AN ERA OF PATIENT-CENTERED OUTCOMES

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Introduction: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey is a national, standardized, publicly reported survey of patients' in-patient hospital care experience that is used for reimbursement and hospital comparisons. We aimed to determine factors associated with poor HCAHPS survey results in order to focus efforts on improving perceived quality in these injured patients.

Methods: All adult trauma patients discharged 6/2012-6/2015 from a single academic medical center were identified from a prospectively collected trauma registry. Patients that met criteria for HCAHPS sampling and returned surveys were included. Scores for overall hospital rating and experience with pain control were dichotomized (high vs low) based on published HCAHPS methodology and analyzed using chi-square and multivariable logistic regression methods.

Results: We identified 2176 eligible trauma patients, of which 9.0% (n=196) returned HCAHPS surveys. Median age was 55 [interquartile range 41-66] and 74.0% were male. Three quarters (75.5%) of patients reported a high hospital rating. Patients with high hospital ratings were older (median 58.5 vs. 47.5 years, $p<0.001$) while patients intoxicated on admission reported lower hospital ratings (57.7% high rating vs. 76.8%, $p=0.04$). There was no difference in hospital rating by gender, transfer status, injury type, ISS, intubation rate, LOS, complications, or payer status (all $p>0.05$). On adjusted analysis including age, ISS, and need for procedural intervention, only age over 60 was independently associated with higher hospital rating (OR 5.9, 95% CI 2.3-14.6, vs. age 18-39). Patients who reported low satisfaction with pain control tended to be younger (median 52 vs 58, $p<0.01$) and were more likely to have been intubated (27.0% vs 14.6%, $p=0.04$) but again there was no difference by gender, transfer status, injury type, ISS, LOS, complications, or payer status ($p>0.05$).

Conclusion: Older trauma patients were more likely to report a higher overall rating of their hospital experience but injury severity, mechanism, and need for operative intervention did not affect scores. This analysis can be used to design initiatives, which attempt to maximize patient perceived quality and reimbursement.

Poster # 62

AN ATTRACTIVE FORCE: REDUCED RISK-ADJUSTED MORTALITY FOR SEVERE TRAUMATIC BRAIN INJURY PATIENTS MANAGED AT MAGNET-DESIGNATED HOSPITALS

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Introduction: We sought to determine whether trauma centers with the performance-driven Magnet recognition nursing credential had improved survival for traumatic brain injury (TBI) patients compared to non-Magnet centers. We hypothesized that Magnet hospitals would have decreased adjusted mortality for moderate (MOD) and severe (SEV) TBI compared to non-MAGNET counterparts.

Methods: All adult (≥18) admissions from 2009-2013 to the 13 Magnet and 17 non-Magnet trauma centers in Pennsylvania with head Abbreviated Injury Scale (AIS) scores ≥3 were extracted from the Pennsylvania Trauma Outcome Study database. Patients presenting dead on arrival or transferred to other facilities were excluded from analysis. The population was separated into moderate (MOD: AIS≥3; GCS9-12) and severe (SEV: AIS≥3; GCS≤8) TBI subgroups. Multilevel mixed-effects logistic regression models accounting for clustering within facilities and controlling for demographics and injury severity assessed the impact of Magnet-designation on mortality.

Results: A total of 7,957 patients met inclusion criteria (3,355 Magnet; 4,602 non-Magnet). TBI patients treated at Magnet centers had a 20% adjusted reduction in mortality compared to non-Magnet counterparts (AOR: 0.80; 95% CU 0.65-0.99; p=0.039), when controlling for age, temperature, systolic blood pressure (SBP), head AIS, ISS, GCS, injury type (penetrating), and admission year. Multilevel analysis on TBI subgroups found SEV treated at Magnet centers had decreased mortality (AOR: 0.78; 95%CI 0.62-0.99; p=0.030), however no significant difference in mortality was seen for MOD (AOR: 0.84; 95%CI 0.62-1.15; p=0.274).

Conclusion: TBI patients managed at Magnet-designated trauma centers had a 20% adjusted reduction in mortality compared to those treated at non-Magnet centers. Sub-analyses found increased survival only in the SEV subgroup, suggesting moderate TBIs can be equally treated at Magnet and non-Magnet centers.

Variable	Adjusted Odds Ratio (95% CI)	p-value
Magnet Hospital	0.80 (0.65-0.99)	0.039
Age	1.05 (1.04-1.05)	<0.001
Temperature	0.93 (0.90-0.95)	<0.001
SBP	1.00 (0.99-1.00)	<0.001
Head AIS	1.31 (1.25-1.38)	<0.001
ISS	1.04 (1.04-1.05)	<0.001
GCS	0.80 (0.78-0.82)	<0.001
Penetrating Injury	8.26 (6.46-10.6)	<0.001
Admission Year	1.05 (1.00-1.10)	0.033
Constant	0.02 (0.01-0.03)	-
N = 7,957		AUROC: 0.82

Poster # 63

CYCLES OF OUR LIVES: THE IMPACT OF AGE ON MOTORCYCLE RELATED INJURIES

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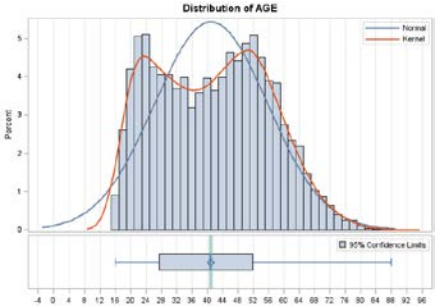
Introduction: Motorcycle crashes (MCC) are believed to be a “disease” of young men. The injuries that result can be a source of significant morbidity and mortality. As the population ages, and older people participate in a variety of recreational activities, injuries are inevitable. We investigated the impact of MCC on the elderly.

Methods: The NTDB National Sample Program Arrival Year 2012 dataset was utilized. Motorcycle accident injuries were defined by ICD-9 e-codes within the range of (810.2 - 823.3) but only containing "motorcyclist" or "passengers on motorcycle". Chi-Squared analysis was used to determine if there is an association between age category (young (YNG) and elderly (ELD)) and several variables of interest, ie helmet use, alcohol use, etc. The age of 55-years was used to define the ELD.



Results: 43,375 patients were included. There were two distinct peaks in age for MCC permitting us to compare YNG and ELD. Both groups were mostly male. Helmet use was more common in ELD (70.9% vs 66.2%, p=0.004). Alcohol use was less common in the ELD (14.4% vs 22.9%, p<0.0001). ELD had a higher frequency of ISS 16-75 (37.6% vs 32.0, p<0.0001) and were more likely to sustain injury to the face, chest, back, and upper extremity (AIS 2-5, p<0.01). ELD more commonly presented with shock (4.3% vs 3.7%), require blood transfusion (14.5% vs 9.4%) had a longer LOS (7.58 d vs 6.28 d), and less frequently were discharged home (61.4% vs 68.7%), p<0.0001. Mortality was higher for ELD (4.3% vs 3.7%, p<0.0001)

Conclusions: A clear bimodal age distribution is demonstrated from these data. Despite having similar body region injuries, elderly patients are sicker, require more resources, and have a higher mortality. These findings may suggest that a different approach to care processes may be warranted for elderly MCC patients. Finally, this may identify a need for a unique injury prevention strategy for this at-risk group of elderly patients.

Poster # 64

INTERNATIONAL EXTERNAL VALIDATION AND NODIFICATION OF THE GERIATRIC TRAUMA OUTCOME SCORE BY JAPAN TRAUMA DATA BANK

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Teikyo University Hospital

Introduction: The Geriatric Trauma Outcome Score (GTOS) is a user-friendly mortality predicting model developed in US. (J Trauma Acute Care Surg. 2016; 80:204-209) The purpose of this study was to validate and modify this with the sample of Japan Trauma Data Bank (JTDB).

Methods: We used the complete datasets from the JTDB2015 and identified all subjects >65 years of age. Age, ISS, PRBCs transfused in the first 24 hours, and mortality were extracted. The area under the receiver operating characteristic curve (AUC) for the original GTOS formula, where GTOS = [age] + [ISSx2.5] + [22 if transfused any PRBCS by 24 hours after admission], was applied for the sample from JTDB. We constructed the mortality predicting model by logistic regression for the sample of JTDB and estimated the j-GTOS.

Results: From the validation JTDB sample, 45001 subjects were extracted with a median (IQR) age of 78.0(71.0-84.0). Within 24 hours, 6908(15.3%) were transfused PRBC. The median ISS (IQR) was 10.0(9.0-20.0) and the crude mortality was 10.9%. The AUC by the original GTOS for JTDB was 0.841(0.836-0.846). The mortality was estimated by logistic regression as Mortality=-6.686 + 0.034xAge+0.090xISS +0.967[if BT].The j-GTOS was developed as; j-GTOS = [age] + [ISSx2.6] + [28 if transfused]. The AUC by j-GTOS (IQR) was 0.846(0.840-0.852).

	Parkland Sample	Cook AC et al.	JTDB
Age, median (25th IQR, 75th IQR), y	75.5 (69.0–82.0)	76.0 (69.5–82.5)	78.0(71.0-84.0)
ISS, median (25th IQR, 75th IQR)	9.0 (3.0–15.0)	9.0 (3.0–15.0)	10.0(9.0-20.0)
PRBC transfusion at 24 h	11.9%	14.1%	15.2%
Mortality rate	10.8%	11.0%	10.9%
AUC by GTOS (95% CI)	0.819(0.807-0.831)	0.862(0.857-0.867)	0.841(0.836-0.846)

Conclusion: The GTOS was acceptably predicts the mortality with JTDB for the elderly. Further investigation should be needed about j-GTOS.

Poster # 65

POSTINJURY FIBRINOLYSIS PHENOTYPE IS AGE DEPENDENT: GERIATRIC PATIENTS WARRANT PRESUMPTIVE TRANEXAMIC ACID

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OBJECTIVE: Acute fibrinolysis resistance[shutdown(SD)] following severe injury is common and associated with increased risk of organ failure compared to a moderate level of fibrinolysis[physiologic(PY)]. However, elderly patients have increased complications with tPA infusion, and may not benefit from fibrinolytic activity after trauma. The empiric use of antifibrinolytics in trauma remains debated, and we hypothesize that geriatric patients would have a greater potential benefit/risk than younger patients.

METHODS: Retrospective study of two level-1 trauma centers including patients with injury severity score(ISS)>15. Patients were stratified by age: adult(45-64) vs geriatric(≥65); and degree of fibrinolysis(quantified by rapid thrombelastography[rTEG]% clot lysis 30min.): shutdown(SD)<0.8%, physiologic(PY)0.8-2.9%, hyperfibrinolysis(HF)>2.9%, based on pre-existing thresholds.

RESULTS: Of the 1034 patients, 32% were geriatric with a median ISS of 25. Logistic regression controlling for ISS, head injury, blood pressure, and age confirmed increased mortality with HF(p=0.010) compared to SD and a reduction in mortality with PY(p=0.045). Cox regression using the same variable when stratified by age demonstrated increased risk of mortality in HF(1.56 95%CI 1.07-2.33p=0.022) compared to SD and decreased risk with PY(0.65 95%CI 0.43-.96p=0.032). Geriatric patients had increased mortality with HF(1.92 95%CI1.24-3.0p=0.004) compared to SD but not with PY(0.89 95%CI 0.58-1.33p=0.566).

CONCLUSION: Hyperfibrinolysis in geriatric trauma patients is highly lethal and there is no protection from physiologic fibrinolysis. Therefore, empiric tranexamic acid is warranted in geriatric patients, but should be given selectively in younger patients.

*=P<0.05 compared to reference group SD. HF=Hyperfibrinolysis; PY = Physiologic; SD = Shutdown

Poster # 66

EFFECTS OF PATIENT ADMISSION TIME AND TRAUMA SURGEON EXPERIENCE ON INJURY OUTCOMES

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Introduction: The impact of trauma surgeon fatigue during a 24hr in-house call on patient outcomes is unclear. Increasing surgeon experience may mitigate the effects of sleep loss on performance. We hypothesized that earlier time of admission by a more experienced trauma surgeon leads to improved outcomes after injury.

Methods: We conducted a retrospective cohort study using prospectively collected trauma registry and performance improvement data at our Level 1 Trauma Center. Consecutive patients presenting at night from 2013 to 2014 were included. Daytime admissions were excluded to control for differential staffing and resources. Subjects were dichotomized by presentation time into early (6:00 PM-12:00 AM) and late (12:01 AM-7:00 AM) cohorts. Baseline characteristics and clinical variables of the patient cohorts were compared. Second year trauma fellows acting as attendings and staff trauma surgeons were categorized as less and more experienced respectively. The primary study outcome was defined as any complication tracked by our state mandated registry, missed injury, delay in diagnosis, or death. The influence of admission time and trauma surgeon experience on this primary endpoint was examined using multivariate logistic regression accounting for surgeon level clustering.

Results: Overall, 2078 patients presented either during early (n=1189) or late (n=889) night. Compared to early admissions, subjects in the late group were younger (39±18 years vs. 43±20 years, $p<0.005$), more likely to be black (71 vs. 66%, p=0.02), and more often sustained penetrating injuries (35% vs. 30%, p=0.02). The cohorts were not different with respect to Deyo-Charlson index, insurance status, SBP, GCS, TRISS, or need for surgery. Likewise, no difference in admitting trauma surgeon age, experience, or unadjusted primary study outcome (early 14% vs late 16%, p=0.206) was detected between the cohorts. After controlling for patient age, race, Deyo-Charlson index, mechanism, TRISS, admission time and need for surgery, trauma surgeon experience was independently predictive of outcomes. Trauma patients admitted at night by fellows in the attending role were 36% *less* likely to sustain complications or death than those admitted by staff surgeons (adjusted OR 0.64; 95% CI: 0.41-0.99). Importantly, subgroup analysis of early and late cohorts demonstrated this protective effect of fellow care only in patients admitted after midnight (p=0.03).

Conclusion: Nighttime initial trauma care by fellows in an attending role was associated with improved outcomes. Our findings suggest that sleep loss may in fact have a greater effect on more experienced trauma surgeons. Further study is warranted to explore the effects of fatigue on trauma surgeons with varying experience levels to determine ideal nighttime trauma staffing models.

Poster # 67

DEVELOPMENT OF SPINAL CORD INJURY SERVICE IMPROVES OUTCOMES AND TRAUMA SERVICE PERFORMANCE

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Introduction: A step-wise multidisciplinary approach to the injured trauma patient has been reported to have an overall benefit to patient outcomes, with reduction in mortality and improved morbidity. The objective of this study was to determine whether the implementation of a dedicated Spinal Cord Injury Service (SCIS) would impact outcomes of a patient specific population on the trauma service.
Methods: During a 5-year period, all spinal cord injury (SCI) patients on the trauma service were reviewed. In 2013, a twice weekly rounding dedicated SCIS was initiated in addition to daily trauma service rounding team. This new multidisciplinary service, the post-SCIS, was compared to the 2011-2012 pre-SCIS. The primary outcome was mortality. The two groups were compared for age, gender, hospital length of stay (HLOS), intensive care unit (ICU) LOS, ventilator free days, and infe
ctious complications.
Results: 95 patients were retrospectively reviewed. Pre-SCIS included 41 patients and 54 patients in the post-SCIS group. The mean age was 46.8 ± 2.36 years, 79% male and 21% female. Analysis of patients in the post-SCIS compared to those of the pre-SCIS revealed shorter HLOS (34.8 vs 23 days, p=0.004), shorter ventilator days (63.3 vs 20.2 days, p<0.001) and less nosocomial infections (22% vs 1.8% , p=0.002). While the mean ICU LOS of post-SCIS implementation was shorter than the pre-SCIS (17.9 vs 12 days, p=0.089), this relationship was not significant. At the same time, analysis of mortality in pre-SCIS showed 5.7 times more likely to expire compared to post-SCIS, however no statistical difference between the two groups was appreciated (odds ratio, 5.73; 95% confidence interval 0.62-53.4; p=0.087).
Conclusion: The application of a SCIS team in addition to the trauma service suggest that a structured coordinated approach to this injury specific patient population can have an expected improvement in hospital outcomes and shorter length of stays. We believe this clinical collaboration provide distinct specialist perspectives and therefore optimize quality improvement.

All Patients	**pre-SCIS *(n=41)***	**post-SCIS *(n=54)***	**p-value**
age	45.9	47.4	
HLOS (d)	34.8	23	0.004
ICU (d)	17.9	12	0.089
Ventilator (d)	49	21	<0.001
Nosocomial infections	9	1	0.002
mortality	4	0	0.087

Poster # 68

LONG-TERM FUNCTIONAL OUTCOMES FOLLOWING BLUNT CEREBROVASCULAR INJURY: A 20-YEAR EXPERIENCE

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Introduction: Since blunt cerebrovascular injury (BCVI) was first recognized over twenty years ago, significant improvements have been made in both diagnosis and treatment. While short-term follow up of these patients has shown that BCVI-related stroke was associated with poor functional outcomes post-discharge, little is known regarding their long-term functional outcomes. The purpose of this study was to evaluate the impact of BCVI on those long-term outcomes.

Methods: All patients with BCVI from 1996-2014 were identified from the trauma registry. Functional outcome was measured using the Boston University Activity Measure for Post-Acute Care (AM-PAC) to assess mobility (normal>84), daily activity (normal>84), and cognitive function (normal>56) via telephone interview. Multiple regression analysis was performed to identify potential predictors of outcome after BCVI.

Results: 509 patients were identified. Overall mortality was 18% (BCVI-related = 1%). Of the 417 survivors, follow-up was obtained in 77 (18%). Mean follow up was 5 years, with a maximum of 19 years. Mean age and injury severity score (ISS) were 47 and 25, respectively. 6 (8%) patients suffered strokes. Mean AM-PAC scores were 59 (mobility), 58 (activity), and 44 (cognitive function), each indicating significant impairment compared to normal. Multiple regression models utilizing age, traumatic brain injury, ISS, and presence of stroke identified age as a predictor of decreased mobility ($b=-0.24$, $p=0.043$), ISS as a predictor of decreased mobility ($b=-0.67$, $p<0.0001$), activity ($b=-0.81$, $p<0.0001$), and cognitive function ($b=-0.28$, $p=0.011$) and stroke as a predictor of decreased activity ($b=-17.8$, $p=0.048$) and cognitive function ($b=-10.6$, $p=0.033$).

Conclusions: Development of stroke and increased injury severity resulted in worse long-term functional outcomes following BCVI. In fact, multiple regression analysis identified both ISS and stroke as independent predictors of significant impairment in both daily activities and cognitive function. Thus stroke prevention with optimal diagnostic and treatment algorithms remains critical in the successful treatment of BCVI as it has significant impact on long-term functional outcomes, and is the only *modifiable* predictor of outcomes in patients following BCVI.

Poster # 69

DETERMINATION OF A PATHWAY FOR MANAGEMENT OF LOW MECHANISM TRAUMATIC INTRACRANIAL HEMORRHAGE

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Introduction: Traditionally at our institution, the majority of patients with isolated intracranial hemorrhage (ICH) sustained from a low energy mechanism (defined as found down, fall from ≤ 6 ft, and assault) were admitted to our Trauma Service, often impacting our surgical intensive care unit (SICU) bed utilization. Through a multidisciplinary workgroup, the "Isolated, Low Energy Mechanism ICH Pathway" was created in which patients are first evaluated by the trauma team to ensure the isolated nature of the ICH and are then admitted to the most appropriate treatment team (Trauma, Internal Medicine, Neurology or Neurosurgery) depending on the global condition of the patient. We hypothesized that this new pathway would improve patient throughput and decrease the burden of primary care by the Trauma Service, while having no impact on outcome.

Methods: All adult patients (age ≥ 18 years) with isolated ICH admitted to University Hospital (UH) were identified by querying the trauma registry between the years of 2008 to 2014. Patients were stratified according to injury severity score (ISS), age and probability of survival (Ps; determined by TRISS). Patients admitted between 2008 and 2010 were placed into a pre-pathway group (PRE), and those admitted between 2012 and 2014 were placed into the post-pathway group (POST). Patients admitted in 2011 were excluded since this was the year the pathway was implemented. Patients within each group were further subdivided by the admitting service (Trauma, Internal Medicine, Neurology and Neurosurgery) for further analysis. The primary outcome was mortality, and the secondary outcomes were length of stay (LOS) and ICU LOS. Outcome was compared between the PRE and POST groups. The ratio of Ps to actual survival (As; 6 month) in each group was also compared between the PRE and POST groups. A student t-test, Fisher's exact t-test and Chi Square test were used to determine associations and differences between groups.

Results: 4088 adult patients with traumatic brain injury (TBI) were admitted between the years of 2008-2014. Of these, 1709 met the low energy mechanism, isolated ICH criteria during our two study periods, with 711 patients in the PRE group and 998 in the POST group. Mean age was higher (61.7 vs 56.7, $p<0.0001$) and ISS was lower in the POST group (17.8 vs 18.8, $p <0.0131$). However, there was no difference between the ratio of Ps to As between the PRE and POST groups (0.92 vs. 0.96, $p= 0.621$), indicating similar risk profiles. The percent of adults with ICH from a low energy mechanism that were admitted to the trauma service decreased from 73% to 37% ($p<0.0001$). There was no difference in overall mortality between the PRE and POST groups (14.0% vs 13.3%, $p = 0.668$). Mean LOS decreased with the pathway from 8.9 days to 5.7 days ($p < 0.0018$), and mean ICU LOS decreased from 4.2 days to 2.6 days ($p < 0.0001$).

Conclusion: Isolated ICH can be safely managed through a multidisciplinary pathway with an improvement in LOS and ICU LOS while not impacting mortality. Our "Isolated, Low Energy Mechanism ICH Pathway" has allowed us to optimize trauma-related resources and reduce costs associated with length of stay and ICU utilization.

Poster # 70

GERIATRIC TRAUMA PATIENTS, PRE-INJURY MEDICATIONS AND COAGULOPATHY

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Introduction: Geriatric trauma is increasing due to demographic changes. Elderly patients can be on medications that can affect thrombostasis and also have trauma induced coagulopathy. In elderly trauma patients presenting to our Level 1 trauma center, we aimed to determine if exposure to preinjury medications affected coagulation parameters at admission or clinical outcomes during the hospitalization.

Methods: After IRB approval, all patients > 65 years presenting as a trauma activation were screened and entered into this prospective cohort study. Each patient had a TEG done along with admission labs for this study. Variables were obtained from the Trauma registry and the medical records and included demographics, mechanism, ISS, medications (specifically ASA, Plavix, warfarin, heparin, novel anticoagulants), initial labs, transfusions within 24h, number of operations, hospital and ICU length of stay and mortality during hospitalization. Data analysis was done with SAS using Fisher's Exact, Wilcoxon Rank and Kruskal-Wallis tests.

Results: A total of 100 patients were entered between July and Dec 2015, 54% were male. Median ISS was 9 (Range: 1 – 43). 51% were on any of the medications of interest (ANY): of which 84% (n=43) were on ASA, 18% on ASA/plavix, 8% on therapeutic anticoagulation. 49% were on none of these medications (NONE). There was a small difference in age between the ANY and NONE groups (Median: 76 (Range: 65 - 97) vs 72 (65 – 97), p=0.0352). There were no differences between the two groups in BMI, ISS, initial PT, INR, PTT levels, transfusions within 24 hours, number of operations, hospital and ICU length of stays and mortality. TEG parameters-- MA and LY30 were significantly different between ANY and NONE groups. MA: Median: 68.8 (Range: 50.5 – 79.4) vs. 66.1 (18.9 – 75.3), p=0.0111. LY30: Median: 0.6 (Range: (0 – 11.7) vs 1.3 (0 – 15.9), p=0.0196. The ANY group was then separated into ASA only and ASA/Plavix groups and compared to the NONE group. Again, there were no differences across these three groups expect in TEG parameters. The MA component of TEG was again significantly larger in ASA only group (Median: 70.3 (Range: 52.5 -79.4) vs 66.1 (18.9 – 75.3), p=0.0207). The LY30 trended toward lower in the ASA only group (Median: 0.5 (Range: 0 – 11.7) vs 1.3 (0 – 15.9), p=0.0566).

Conclusion: Elderly trauma patients on preinjury medications, even ASA, can have signs of hypercoagulability and increased clot lysis based on TEG parameters but without abnormalities in standard coagulation tests. These findings underscore the need for further study on the impact of routine medications on coagulopathy in elderly trauma patients.

Poster # 71

THE RISK OF VENOUS THROMBOEMBOLISM AFTER TRAUMA DESPITE CHEMOPROPHYLAXIS: WHEN "BEST PRACTICE" IS NOT ENOUGH

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Introduction: The hypercoagulable state associated with traumatic injury is a known risk factor the development of deep venous thrombosis (DVT) and pulmonary embolism (PE), collectively referred to as venous thromboembolism (VTE). A small portion of patients, even after receiving prophylaxis, still develop VTE. This study was designed identify those patient characteristics which were associated with the development of VTE after trauma despite chemical prophylaxis.

Methods: A retrospective analysis of national trauma admissions between 2013 and 2014 was performed using the Trauma Quality Improvement Program (TQIP) database. Inclusion criteria included documented use of chemical prophylaxis and length of stay ≥ 3 days. VTE was defined as the development of DVT, PE, or both. Admissions were excluded if VTE complication status was unknown. Bivariate and multivariable analysis were used to predict the development of VTE.

Results: There were 140,141 admissions which met study criteria. Of these admissions, 4,666 patients (3.33%) developed VTE. Based upon a backward elimination logistic regression model, independent risk factors for development of VTE despite prophylaxis were time to initiation of prophylaxis > 48 hours after admission (OR 2.56, p <0.0001), initial GCS < 10 (OR 2.11, p = 0.0003), and BMI > 30 (OR 1.98, p = 0.0007). Injury type, injury severity, and method of chemical prophylaxis did not significantly affect the odds of VTE.

Conclusion: Independent risk factors for developing VTE despite receiving chemical prophylaxis are an initial GCS < 10, BMI > 30, and the initiation of prophylaxis greater than 48 hours after admission. These results suggest that efforts to reduce the incidence of VTE should focus on increased surveillance and initiation of prophylaxis sooner in this population. Furthermore, patients with neurologic impairment, obesity, and/or delays in starting prophylaxis represent a cohort that would benefit from DVT screening.

Poster # 72

REVIEW OF VIDEOTAPED TRAUMA RESUSCITATIONS IMPROVES EFFICACY OF PATIENT CARE

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Introduction: Time is of the essence in care of the critically injured patient. Expedient initial assessment, resuscitation and dispostion of the patient to the operating room (OR), intensive care unit (ICU) or computed tomography (CT) suite improves care. Videotape reviews are used to improve performance in athletics and public speaking. We hypothesized reviewing videotapes of our highest level trauma alerts would improve outcomes at our Level 1 Trauma Center.

Methods: All critically injured patients at our Level 1 Trauma Center who meet our highest level of activation criteria underwent videotaping and timing of their resuscitation in the Trauma Bay (TB) beginning November 2014. These DVDs were reviewed once a week by trauma attendings, trauma chief residents and senior level nursing. Demographics such as age, gender, mechanism of injury, trauma bay dwell times and mortality were recorded.

Results: Over a 15 month period, 432 highest level trauma alerts were videotaped and reviewed. Monthly TB dwell times over the 15 month period are shown in the figure below. Initial TB dwell time was 28.6 +/- 13.2 minutes during the first month. After three months the mean TB time was decreased to 16.6 +/- 7.9 minutes ($p < 0.006$) and 15 months later the mean TB time was 15.8 +/- 8.9 minutes ($p < 0.0001$), both statistically extremely significant. The average TB dwell time has remained constant at 15 min over the last three months and likely represents the optimal mean TB dwell time. The mortality in the first three months of the study was 15.5 % and decreased to 8.8 % during the last three months but this was not statistically significant ($p = 0.19$). Trauma attending response time within 15 minutes remained constant at greater than 93% during each month of the study period. After a survery, all chief residents involved with the process have found reviewing the videos extremely helpful. They all have learned how to be more efficient at TB resuscitations, delegating responsibilities to junior residents and prompt disposition of patients to the OR, ICU or CT scanner.

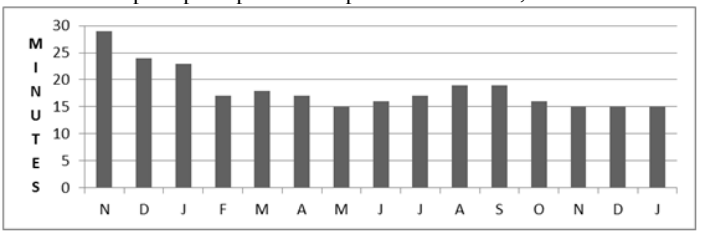

FIGURE 1: TB time vs. Month

Conclusion: The review of videotaped trauma alerts has improved resident leadership and delegation skills. TB dwell times significantly decreased with this technology. Although mortality was not significant decreased, it did appear to improve. TB resuscitations are now much more efficient and organized at our Level 1 Trauma Center. We will continue to review trauma videos with surgical residents on a weekly basis as part of resident education and improved patient care.

Poster # 73

MOVING THE NEEDLE ON RATES OF PERIOPERATIVE DEEP VEIN THROMBOSIS (DVT) AND PULMONARY EMBOLUS (PE) IN NON-TRAUMA PATIENTS: A MULTIDISCIPLINARY PROCESS IMPROVEMENT PROJECT BASED ON A TRAUMA BEST PRACTICE MODEL

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Introduction: Hospital acquired perioperative DVT/PE rates are publicly reported and may affect reimbursement rates from The Centers for Medicare and Medicaid (CMS) in patients undergoing hip and knee replacements. At a busy urban Level 1 trauma center and elective orthopedic surgical hospital, we recognized that our unadjusted DVT/PE rate of 9.19% per 1,000 surgical patient discharges for Fiscal Year 2014 (FY14: July-July) was higher than expected. The trauma service line was noted to have a superior risk adjusted DVT/PE rate as reported in national Trauma Quality Improvement Program (TQIP) data. A process improvement (PI) plan using trauma service policies as a model was initiated throughout the hospital to decrease rates of DVT and PE.

Methods: This Multidisciplinary Team PI project reviewed individual cases of DVT/PE in all surgical patients to assess reasons that rates were higher than expected. Best practice management guidelines were developed for all service lines to follow after reviews of the DVT/PE cases. The PI team, including physicians, pharmacists, therapists, nurses and hospital quality improvement staff, offered recommendations to direct both a practice and culture change. Physician champions from trauma surgery, orthopedic surgery and internal medicine were identified. Protocol changes in the joint replacement patients went into effect November, 2014.

Results: The review documented the following five opportunities for improvement: poor understanding of risk of DVT/PE; non-universal use of sequential compression devices in the operating room; inconsistent use of and under-dosing of enoxaparin; delays in initiation of enoxaparin; and delays in early mobilization. After implementation of the focused PI plan, the overall DVT/PE rate in all surgical patients decreased from 9.19% FY14 to 8.23% FY15 with an additional decrease to 6.99% July through December 2015. This was an overall rate decrease of 24% ($p=0.24$). For patients undergoing total hip or knee joint replacement, the DVT/PE rate decreased from 10% in FY14 and 12.9% in FY15 to 6.2% July through December 2015. ($p=0.25$), an absolute decrease of 52%. Specifically, the DVT/PE rate decreased from 20.3% pre-protocol change to 7.1% post-protocol change in patients undergoing hip or knee joint replacements. ($p=0.04$, OR 2.9)

Conclusion: The DVT/PE hospital wide PI project emphasized a heightened awareness of DVT/PE risk in surgical patients and led to a significant increase in postoperative mobilization, routine mechanical prophylaxis prior to induction of anesthesia, and pharmacological agents based on risk stratification. This PI initiative, modeled on the successful best practices of the trauma service line, produced an improvement in patient care throughout the hospital and most robustly in the elective orthopedic population with a statistically significant decrease in DVT/PE. This will have positive implications for reimbursement from CMS.

Poster # 74

DOUBLE JEOPARDY: IS TRAUMA TEAM ACTIVATION INDICATED FOR ALL INJURED PREGNANT PATIENTS?

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Introduction: Most pregnant trauma patients presenting with significant mechanism or injury will trigger activation of the trauma team (TTA) with obstetrics service support (OB). In contrast, minor trauma in pregnancy may be evaluated only by the obstetrics team with occasional consultation with the trauma service. We theorized that even minor trauma was associated with significant short and long term complications necessitating combined trauma and obstetric service management.

Methods: We retrospectively reviewed our trauma and obstetric service's prospective database for all patients admitted for injury over the most recent 8 year time frame. 486 patients were categorized as primary TTA or OB assessment only. Data of interest included: mechanism of injury/ISS, gestational age at injury, emergency obstetrical complications, and interventions. Late follow-up of maternal and fetal complications during delivery and postpartum were recorded.

Results: Mechanisms of injury: motor vehicular collisions (366, 75%), falls (97, 20%), assault (13, 3%), other (10, 2%). Mean ISS: 2.3 ± 5.5. Mean age: 28.8 ±5.4 years; gestational age 3 - 40 weeks (mean, 26 ± 8.6). 332 (68%) had routine TTA and OB evaluation with fetal monitoring. In contrast, 154 patients (32%) were admitted directly to OB with optional TTA. Late OB complications were frequent (276 patients (57%), with a trend toward more frequent fetal monitoring abnormalities in TTA (p=0.07). Maternal ICU admissions were significantly more common in patients evaluated by the trauma service (p=0.04). Logistic regression analysis showed that motor vehicle collision, third trimester status and TTA predicted increased risk for short term complications (p=0.03).

Conclusions: Our findings suggest that even minor trauma during pregnancy is associated with significant short and long term obstetric and fetal complications, particularly motor vehicle collisions occurring during the third trimester .These data support routine TTA in concert with OB consultation for all injured pregnant patients.

		Trauma Team Activation group (N=332)	Obstetric evaluation group (N=154)	P value
Mechanism N (%)	MVA	298 (90)	68 (44)	<0.0001
	Falls	23 (48)	74 (69)	<0.0001
Gestational age N (%)	Median, weeks	26.4	24.8	0.05
	1st trimester	19 (6)	23 (15)	0.001
	2nd trimester	165 (50)	73 (47)	NS
	3rd trimester	148 (45)	58 (38)	0.016
ISS	Mean ISS	2.27	2.29	NS
Short term complications N (%)	Placental abruption	3 (0.9)	0	NS
	Intrauterine fetal death	2 (0.6)	0	NS
	Emergency CS	3 (0.9)	1 (0.65)	NS
	Preterm labor	2 (0.6)	1 (0.65)	NS
	Maternal ICU admission	11 (3.3)	1 (0.65)	0.04
	Fetal monitoring abnormalities	36 (10.8)	9 (6)	0.07
Late complications (276 patients)	Preterm delivery (< 37 weeks)	33 (18.3)	18 (19)	NS
	Low birth weight (< 2500 g)	14 (8)	7 (7.5)	NS
	5-min Apgar score <7	14 (8)	8 (9)	NS
	Intra-partum fetal death	2 (1.1)	1 (1.1)	NS
	Emergency CS	31 (17)	22 (24)	NS

Poster # 75

VARIABILITY IN COMPUTED TOMOGRAPHY (CT) IMAGING OF TRAUMA PATIENTS AMONG EMERGENCY DEPARTMENT PHYSICIANS (EDP) AND TRAUMA SURGEONS WITH RESPECT TO MISSED INJURIES, RADIATION EXPOSURE AND COST

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Introduction: There is substantial variability in the CT scans desired by EDP, surgical chief residents (SCR) and trauma attending surgeons (TAS). We quantified these differences and studied the effects of each group's decisions on missed injuries, cost, and radiation exposure.

Methods: Over 6 mo at a single urban level 1 trauma center, all blunt trauma activations were studied. After completing the secondary survey, plain films, and focused abdominal sonogram (FAST) exam, the EDP and SCR each completed a form to record desired CT scans (head, cervical spine, face, chest, abdomen/pelvis). The TAS made the final determination regarding scans to be performed. Missed injuries were defined as any not identified by initial imaging for the TAS, and any that would have not been identified properly by the scans desired by the EDP or SCR. Extremity injuries, and injuries obvious on physical exam or visible on plain film were excluded. Radiation dose and cost for desired scans were calculated using the median value for each from the scans actually performed. Fisher exact or chi-square tests for multiple comparisons were used, $p< 0.05$.

Results: TAS ordered significantly more CT scans, 1,012 vs. 882 (EDP) and 884 (SCR) resulting in de facto pan-scan in 78.4% (TAS) vs. 63.7% (EDP) and 68.5% (SCR) (all, $p<0.0001$). This led to higher cost per patient of CT scans by TAS of $344 vs. $267 (EDP) and $292 (SCR) (all, $p<0.0001$). Radiation exposure did not differ (18 mSv (TAS) vs. 13 mSv (EDP) ($p=0.185$) and 15 mSv (SCR) ($p=0.488$). Of total injuries, TAS missed 0.96% whereas EDP missed 10.6% and SCR 7.2% (all, $p<0.0001$). The relative risk of missed injury was 11.0 (95% CI 4.8-25.19) for TAS vs. EDP and 7.5 (95% CI 3.22-17.46) for TAS vs SCR.

Conclusion: TAS utilize CT most liberally and more precisely in blunt trauma patients, resulting in higher cost but no increase in radiation exposure per patient. This is offset by a reduction in the number of injuries missed by TAS, which expedites diagnosis and management and may decant the CT suite, improving access. This could be the result of overreliance on the accuracy of the physical exam or plain films by EDP, as well as inexperience on the part of SCR.

Poster # 76

TRAUMA TRANSITIONAL CARE COORDINATION: PROTECTING THE MOST VULNERABLE TRAUMA PATIENTS FROM HOSPITAL READMISSION

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Introduction: Unplanned hospital readmissions increase health care costs and patient morbidity. We hypothesized that a program designed to reduce trauma readmissions would be effective.

Methods: A Trauma Transitional Care Coordination (TTCC) program was created to support patients at high risk for readmission. Patients were identified prior to discharge via a checklist including: previous readmission, lack of regular home assistance/home care services, poor or absent insurance, new traumatic brain injury, history of psychiatric disease, drug abuse, multiple co-morbidities without a primary care provider (PCP), pulmonary embolism or vascular injury without PCP, new tracheostomy, high output fistula, and large open wounds before definitive closure. TTCC interventions included call to patient (or caregiver) within 72 hours of discharge to identify barriers to care, complete medication reconciliation, coordinate medical appointments or home visits, and individualized problem solving. Information on all 30 day readmissions was collected. Participants completed a ten question quality of life and satisfaction survey. 30 day readmission rates were compared with population based and risk-adjusted rates of readmission using published benchmarks.

Results: 260 patients were enrolled in the TTCC program from 1/14 – 9/15. 33.3% (n=80) of enrollees were uninsured, 45.4% (n=109) reported current substance abuse, 29.1% (n=70) had a current psychiatric diagnosis, and 60% (n=144) had multiple co-morbidities without a PCP. 74% (n=193) attended outpatient trauma appointments within 14 days of discharge. 44% (n=115) attended appointments with new PCPs within 30 days of discharge. 96.3% were successfully followed, only 9 patients lost to follow-up. The majority of patients felt TTCC helped them understand their healthcare and ultimately felt able to care for themselves at their new normal. Only 6.6% (n=16) of patients were readmitted in the first 30 days after discharge as compared to recently published population based trauma readmission rates (6.6% vs. 19%, $p<0.0001$).

Conclusion: A nursing-led TTCC program successfully followed patients and was associated with a significant decrease in 30 day readmission rates for high risk trauma patients. Estimated cost savings for such a reduction nationwide would approach $374 million per year. Targeted outpatient support for those most vulnerable patients can lead to better utilization of outpatient resources, increased patient satisfaction and more consistent attainment of pre-injury level of functioning or better.

Poster # 77

COMPETING RISKS ANALYSIS OF FACTORS ASSOCIATED WITH PULMONARY EMBOLISM AND DEEP VEIN THROMBOSIS AFTER TRAUMATIC INJURY

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Introduction: Recent studies suggest that post-traumatic pulmonary embolism (PE) and deep vein thrombosis (DVT) are distinct clinical processes that share similarities in risk. Less understood is how the timing of diagnosis of a thromboembolic event affects the risk for a future event. By this definition, DVT and PE act as competing events. We hypothesized that risk factors and timing of diagnosis for PE and DVT are different, and evaluated this hypothesis using a competing risks analysis.

Methods: Adult trauma patients admitted to a Level I trauma center between July 2006 and December 2010 who received at least one surveillance duplex sonography (DS) of the lower extremity were included. Outcomes evaluated were DVT and PE, and the time-to-event from admission. Patients without either event were statistically censored at the time of discharge. Competing risks survival analysis was used to evaluate potential risk factors for DVT accounting for PE as a competing event, and vice versa.

Results: Of 2,370 patients who met inclusion criteria, 265 (11.2%) had at least one event: 235 DVT-only, 19 PE-only, 9 DVT with subsequent PE, and 2 PE with subsequent DVT. Mortality rates were 3.3% in non-events, 7.7% for DVT-only, and 15.8% for PE-only ($p<0.001$). There were no deaths among patients with PE and DVT. DVT occurred earlier than PE (median 3 days vs. 4 days, respectively). Competing risks modeling of DVT as the primary event identified older age, severe injury (ISS≥15) mechanical ventilation > 4 days, active cancer, history of DVT or PE, major venous repair, male sex, and both prophylactic lovenox and heparin use as associated risk factors. Modeling of PE as the primary event showed younger age, non-severe injury (ISS<15), central line placement, mechanical prophylaxis, and prophylactic heparin use as relevant factors.

Conclusion: PE had opposite risk factor associations to those for DVT. Both PE and DVT are valid competing events to each other, and a failure to account for each introduces bias in the classification of risk. Results suggest that DVT and PE are distinct clinical events that require independent consideration.

Table. Adjusted sub-hazard ratios (95% confidence intervals) of risk factors for DVT and PE

	DVT Primary Event	PE Primary Event
Risk Factor	**sHR (95% CI)**	**sHR (95% CI)**
Mechanical Prophylaxis	-	0.22 (0.06-0.81)
Age at Admission	1.02 (1.01-1.02)	0.94 (0.90-0.97)
Severe Injury	1.38 (1.01-1.89)	0.27 (0.11-0.67)
Male Sex	1.44 (1.04-1.98)	-
Central Line Placement	-	5.78 (1.60-20.86)
Ventilated > 4 days	2.17 (1.59-2.95)	-
Prophylactic Heparin	2.21 (1.52-3.20)	6.63 (2.25-19.56)
Prophylactic Lovenox	2.44 (1.76-3.38)	-
Active Cancer	2.47 (1.17-5.22)	-
Major Venous Repair	2.82 (1.41-5.65)	-
History of DVT or PE	4.53 (2.71-7.57)	-

Poster # 78

"Delay to OR" Fails to Identify Adverse Outcomes at a Level I Trauma Center

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Introduction: The American College of Surgeons Committee on Trauma designed core process measures to be tracked by trauma centers to identify opportunities for improvement (OFI) and prevent adverse outcomes. "Delay to the OR" is one such measure that is widely monitored but has not been well studied. We sought to evaluate the effectiveness of delay to the OR >2 hours (DOR) to independently identify adverse outcomes and OFI at a Level I trauma center.

Methods: All trauma patients who underwent exploratory laparotomy from July 2006 to March 2015 were reviewed. Patients with DOR were identified and compared to those without DOR. To explore the ability of DOR to independently identify adverse outcomes, DOR patients were further divided into those with DOR only and those with DOR in conjunction with at least one other process measure that triggered review. Primary outcome was a complication identified by peer review. Secondary outcome was an identified OFI. Cases with either outcome underwent medical records review to determine if the complication or OFI resulted directly from DOR.

Results: Of the 472 patients who underwent exploratory laparotomy, 109 (23%) had DOR and 363 (77%) did not. There was no significant difference in age, sex, or injury severity between the two groups. DOR patients were more likely to have blunt injury (71% vs. 38%, $p<0.0001$), a higher mean admission systolic BP (123 vs. 115, $p=0.02$), and longer ICU stay (2 vs. 1 day, $p=0.003$). DOR was associated with three other process measures: failed non-operative management ($p=0.001$), delay in diagnosis ($p<0.0001$), and delay in presentation ($p<0.0001$). The rate of complications identified among DOR patients and those without DOR was not significantly different (35% vs. 38%, $p=0.11$). DOR was the sole flagged process measure in 31(28%) patients. This subgroup had no identified complications but incurred two OFI involving nontrauma personnel: one related to improving accuracy of the diagnostic workup and one aimed at timely resource allocation. Neither was associated with adverse outcomes.

	DOR Only (n=31)	DOR & Other Measures (n=78)	*p*
Adverse Outcome	0 (0%)	38 (49%)	<0.0001
OFI	2 (7%)	12 (16%)	0.34

Conclusion: In patients undergoing exploratory laparotomy, DOR fails to independently identify adverse outcomes. These findings suggest that DOR is not an effective indicator of either suboptimal trauma care or adverse outcomes at a Level I trauma center.

Poster # 79

WHEN MINUTES FLY BY: WHAT IS THE TRUE "GOLDEN HOUR" FOR AIRCARE?

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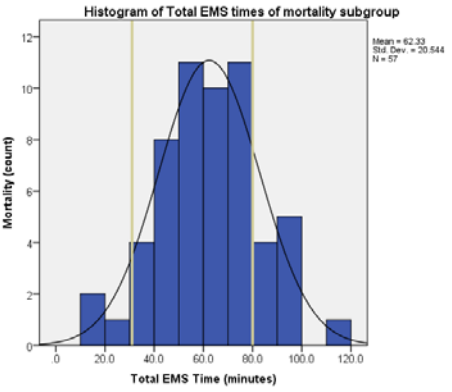
Introduction: The term “golden hour” associates the risk of mortality to the timing of definitive care of trauma patients. A delay of care over an hour has been directly related to poorer outcomes. For this reason, air transport was developed to hasten the transport time of trauma patients. However, no prior civilian studies have determined whether air transport has had any effect on this phenomenon. We hypothesized that total transport time greater than 60 minutes would be associated with increased mortality.

Methods: This was a retrospective, multicenter study of adult (≥18 y/o) trauma patients transported by air between November 2014 and August 2015. Five institutions contributed to the data. Associations between total EMS transport time and mortality were analyzed using logistic regression. An analysis utilizing descriptive statistics and analysis of variance of those who died was also performed.

Results:A total of 636 patients met inclusion criteria. The population was 70.8% male, and primary mechanism of injury was blunt trauma (86%). Median GCS, ISS, and SI were 15, 14, and 0.72, respectively. Median total EMS time was 65 minutes. A total of 57 (9.2%) patients died. Examination of this subgroup revealed a doubling in mortality after 30 minutes, which was significant by ANOVA analysis ($p<0.0001$). Median GCS, ISS, and SI of this group were 3, 26, and 0.83, respectively. Figure 1 demonstrates the total EMS time for those whom died.



Conclusion: When analyzing time sensitive mortality within the “Golden Hour” for air transport, a time cutoff of 30 minutes was associated with higher rates of death. Seemingly, the likelihood for mortality was significantly less if air transport time was within 30 minutes. Pre-hospital Quality and Performance Improvement analysis of those that died within 30-80 minutes is warranted in order to improve outcomes.

Poster # 80

IS IT TIME TO BENCHMARK COMPLICATIONS FROM THE NTDB? A LONGITUDINAL ANALYSIS OF RECENT REPORTING TRENDS

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Introduction: In the era of value-based purchasing, benchmarking schema such as TQIP are increasingly important. TQIP serves as a comparator between trauma centers but does not establish National minimal complication benchmarks for pay for performance. Payers have approached select complications as never-events and there is rational that due to injury and patient characteristics, achieving a zero incidence of these events is impractical. Prior NTDB analysis through 2005 showed high rates (37%) of centers reporting no complication data making National estimates for determining a more rationale never-event benchmark difficult to ascertain. We hypothesized that given the increased interest in never-events, complication reporting in the NTDB would be markedly improved compared with the historic data.

Methods: The 2008-2012 NTDB and NTDB-NSP weighted files were utilized to calculate yearly National estimates. Rates were compared in all centers and in only those reporting complication data. Hospital characteristics were compared using Students t-test.

Results: From 2008-2012, the NTDB contained raw data on 3,657,884 patients. 16.3% (n=594,894) experienced 1 or more complication (82.7% 1; 17.3% 2+). Excluding the 'other complication' category introduced in 2011, the overall weighted rate was 8.4%-9.2% [Table]. Pneumonia was the most common (2.7-3.0%) and twice the 2005 rate. The number of centers reporting no complication data dropped to a low of 7.5% in 2011 (2008:12.6%, 2009:15.4%, 2010:13.7%, 2012:8.3%). By 2012, nearly all level Is reported complication data whereas 46.4% of level IVs reported none (I 0.5%, II 2.7%, III 8.5%, p=0.04). Data was reported the least frequently in non-teaching hospitals (15.8%, p=0.007), those in the South (19.6%, p=0.007), and those with <200 beds (23.6%, p= 0.005).

Conclusion: Overall rates of complications were nearly two-fold higher than the 2005 historic data. Reporting has dramatically improved and the NTDB may provide a valuable platform for establishing rationale and achievable benchmarks for specific complications of interest.

	2008		2009		2010		2011		2012	
	all centers	excluding non-reporters	all centers	excluding non-reporters	all centers	excluding non-reporters	all centers	excluding non-reporters	all centers	excluding non-reporters
All complications										
Exclude other	8.57%	8.79%	8.25%	8.40%	8.62%	8.70%	8.22%	8.43%	9.22%	9.22%
Including other	-	-	-	-	-	-	31.37%	32.20%	26.18%	26.18%
Pneumonia	2.95%	3.02%	2.82%	2.87%	2.73%	2.76%	2.60%	2.67%	2.83%	2.83%
ARDS	1.66%	1.70%	1.30%	1.37%	1.34%	1.35%	1.48%	1.52%	1.11%	1.11%
DVT	0.99%	1.02%	1.00%	1.02%	1.21%	1.22%	1.08%	1.11%	1.03%	1.03%
Decubitus ulcer	0.90%	0.93%	0.62%	0.63%	0.53%	0.54%	0.56%	0.57%	0.52%	0.52%
Acute Renal Failure	0.90%	0.92%	0.97%	0.99%	1.04%	1.05%	0.89%	0.92%	0.98%	0.98%
Sepsis	0.88%	0.91%	0.77%	0.78%	0.71%	0.72%	0.18%	0.19%	0.40%	0.40%
PE	0.37%	0.38%	0.32%	0.33%	0.32%	0.32%	0.32%	0.32%	0.36%	0.36%
UTI	-	-	-	-	-	-	1.48%	1.52%	2.03%	2.03%

Poster # 81

THE IMPACT OF A GERIATRIC TRAUMA SERVICE ON 30-DAY READMISSIONS AND MORTALITY AFTER DISCHARGE

Wen Hui Tan MD, Ricardo Ramirez MD, Pam Choi MD, Dajun Tian BS, MS, Jad Chamieh MD, Timothy Norton RN, Emily Ramirez MBA,RN, Douglas Schuerer* MD, Washington University School of Medicine

Introduction: There has been a well-documented growth in the number of geriatric trauma patients. Due to their diminished reserve and higher number of comorbidities, these patients often have longer lengths of stay and higher hospital resource utilization both in the inpatient and outpatient setting. In the past ten years, a handful of institutions have recognized the need for a multidisciplinary and standardized approach to the geriatric trauma patient, giving rise to the creation of a dedicated geriatric trauma service (GTS). After developing our own GTS, we previously found a decrease in inpatient mortality and length of stay. We hypothesized that our GTS would decrease unplanned 30-day readmissions and mortality after discharge.

Methods: With multidisciplinary input, our hospital's GTS was implemented from January to October 2013. Patients older than 55 years old with single system or minor multisystem traumatic injury were admitted to GTS. Using our trauma registry, we collected demographic data including ISS, AIS scores, in-hospital complications, readmissions, and mortality. For data analysis, patients older than 55 years with traumatic injuries and the above characteristics who were admitted to various services in the calendar year 2012 were used as our pre-implementation group, and patients admitted to our GTS from October 2013 through December 2014 were our post-implementation group. Standard statistical analysis was use to compare baseline characteristics, 30-day unplanned readmissions, and 3-month, 6- month, and 1-year mortality.

Results: A total of 1,403 patients were included in this study: 621 patients in the pre-implementation group and 782 in the post (GTS) group. The GTS patients were significantly older, with a mean age of 77.1 years compared to 74.1 years in the pre-implementation group ($p < 0.001$). Though individual AIS scores differed between groups, the ISS (mean ISS 8.99 vs 8.68 in the pre- and post-implementation groups, $p = 0.27$) and number of comorbidities were not significantly different. Eighty-eight (14.2%) of the pre-GTS group had an unplanned readmission in the first 30 days following discharge, compared to 74 (9.5%) of the GTS patients ($p = 0.0061$). Mortality was not significantly different at 3 and 6 months and at 1 year. At all time points, only age was significantly associated with mortality.

Conclusion: Following the implementation of a dedicated GTS, the proportion of patients with unplanned 30-day readmissions decreased significantly. There is no significant difference between groups in 3- and 6-month mortality or 1-year mortality.

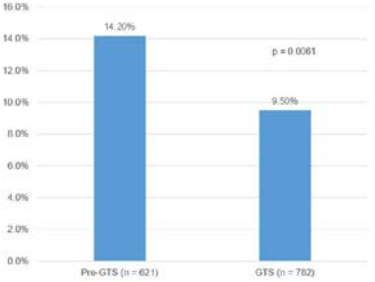
Table 1: Demographics

	Pre-GTS (n = 621)	GTS (n = 782)	p-value
Age (years)	74.11	77.14	< 0001
ISS	8.99	8.68	0.272
AIS Head	1.10	0.79	< 0001
AIS Face	0.12	0.13	0.6891
AIS Chest	0.16	0.35	< 0001
AIS Abdominal	0.05	0.16	0.0757
AIS Extremities	1.48	1.62	0.0257
Length of stay (days)	5.39	4.48	< 0001
Number of comorbidities, *n*	20.78	21.30	0.5163

Table 2: Mortality

	Pre-GTS (n = 621)	GTS (n = 782)	p-value
3-month mortality	7.25%	8.82%	0.2829
6-month mortality	12.72%	14.45%	0.3494
1-year mortality	18.36%	20.46%	0.3237

Figure 1: Unplanned 30-day readmissions



Poster # 82

ENDOTYPE-SPECIFIC MULTIPLE ORGAN DYSFUNCTION PARAMETER SEGREGATES TRAUMA PATIENTS INTO OUTCOME-BASED COHORTS CHARACTERIZED BY AN EARLY, DIFFERENTIAL INFLAMMATION BIOMARKER PROFILE

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Introduction: The design of trials aimed at early immune modification following severe injury has been limited by challenges in defining meaningful intermediate endpoints other than survival. Here, we hypothesized that an optimized Multiple Organ Dysfunction (MOD) parameter could serve as an endotype-specific endpoint to segregate patients into outcome-based cohorts, which could be characterized by dynamic changes in circulating inflammation biomarkers obtained early in the clinical course.
Methods: Using clinical and biobank data of 472 blunt trauma survivors, 376 patients admitted to the ICU and with sequential Marshall MODScores from days (D) 2-5 post-injury were studied. The cumulative MODScores from D2-D5 were then subjected to: 1) supervised decision list analysis (DLA) to determine the optimal MODScore cut-off value which could segregate the largest sample size of patients with adverse outcome; and 2) unsupervised hierarchical clustering analysis (HCA) to identify clusters among trauma patients and apply MODScore as an intermediate endpoint for interventional trials. Inflammation biomarkers (34 cytokines and chemokines) were assayed (by Luminex™) in serial blood samples (3 samples within the first 24 h and then daily up to D5 post-injury). Inflammation biomarker data were analyzed using Two-Way ANOVA ($P<0.05$).
Results: Supervised DLA suggested an optimal MODScore cut-off value of 3: MODscore >3 group (n=72) had dramatically longer ICU length of stay (LOS), days on mechanical ventilation, total LOS, and higher incidence of NI (61%) when compared to the MODScore <3 group (n=304). The unsupervised HCA segregated patients into three distinct groups: Low MODS group (n=242, average MODScore=0.5); Intermediate MODS group (n=99, average MODScore=3); and High MODS group (n=35, average MODScore=6.5). There were statistically significant differences among the three groups with regards to ICU LOS, total LOS, and days on mechanical ventilation being all greatest in the High MODS group, which in turn had a higher incidence of NI (71%) when compared to the Intermediate and Low MODS groups (46% and 19%, respectively). Circulating levels of IL-6, MCP-1, MIG, IP-10, IL-10, sST2, and IL-8 were differentially elevated upon presentation and over time in the High MODS group. These biomarkers exhibited distinct dynamic inflammatory patterns within 24 h, suggesting an early divergence of the inflammatory response which correlates with high MODS.
Conclusion: These results show that early inflammation biomarker patterns correlate with different degrees of MODS severity identified by DLA and HCA of the average MODScore D2-D5. This cumulative MODScore parameter, in turn, correlates with adverse endpoints.Our results also suggest that a subset of biomarkers measured early in the clinical course could be useful to stratify patients into cohorts at high risk for MODS.

Poster # 83

CURRENT OUTCOME OF BLUNT OPEN PELVIC FRACTURES: HOW MODERN ADVANCES IN TRAUMA CARE MAY DECREASE OVERALL MORTALITY

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Introduction: Open pelvic fracture from a blunt mechanism is a rare injury with a high mortality rate (up to 58%). There has been a paucity of literature in the past ten years investigating trends in outcomes of open pelvic fractures. In 2008, the Western Trauma Association published an evidence based algorithm for managing pelvic fractures in unstable patients. The use of massive transfusion protocols with a 1:1:1 PRBC: FFP: platelets ratio has become widespread and there is greater availability of pelvic angiography. The aim of this study is to evaluate the outcome of pelvic fractures and trends in current trauma care. We hypothesize that the development of an evidence-based algorithm, liberal use of pelvic angiography and implementation of a massive transfusion protocol (MTP) have contributed to a decrease in overall mortality for patients with blunt open pelvic fractures.

Methods: A retrospective review in an ACS-verified level I trauma center of all patients who sustained blunt open pelvic fractures from January 2010 to December 2015 was performed. The WTA algorithm with MTP (and 1:1:1 ratios) and rapid availability of angiography were uniformly used. Data collected included age, injury severity score (ISS), transfusion requirements, use of pelvic angiography, length of stay, and disposition. Patients with penetrating injuries and closed fractures were excluded. Data was compared to a similarly designed study from 2005. Dichotomous variables were compared using Chi square tests with significance attributed to a p value < 0.05.

Results: During the study period, there were 1410 patients with pelvic fractures, 71 (5%) were open. Of these, 23 were from blunt mechanisms and made up the study population. Use of angiography was higher and mortality was lower than the previous study. Thirteen patients (57%) were hemodynamically unstable, and 11 had MTP initiated.

Study (n)	Age	GCS	ISS	Patients Transfused	Pelvic embolization	LOS (survivors)	Mortality
2005 (44)	39 ± 2	12 ± 1	30 ± 2	32 (73%)	7 (16%)	22	20 (45%)
2015 (23)	43 ± 4	10 ± 1	30 ± 3	16 (70%)	10 (43%)	22 ± 5	3 (13%)
P value	-	-	-	0.62	0.014	-	0.025

Conclusions: The changes in trauma care for patients with open pelvic fracture have included the use of an evidence based algorithm, massive transfusion protocols and increased use of angio-embolization. Mortality for open pelvic fractures has decreased with these advances.

Poster # 84

AN EPIDEMIOLOGICAL OVERVIEW OF A DECADE OF GUN VIOLENCE HOSPITALIZATIONS IN A MATURE TRAUMA SYSTEM

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Introduction: Gun violence is a controversial public health issue plagued by a scarcity of recent research. We sought to provide a decade-long epidemiological overview of gun violence in Pennsylvania, analyzing temporal trends in mode, intent, and outcome. We hypothesized that decreased adjusted mortality and increased functional status at discharge (FSD) would be observed for gunshot wound (GSW) victims over the 10-year study period.

Methods: All admissions to the Pennsylvania Trauma Outcome Study (PTOS) database from 2003-2012 were queried. GSWs were defined as E-Codes 922.0-.9, 955.0-.4, 965-.4, 970, 979.4, and 985.0-.4. Collected variables included patient demographics, firearm type, intent (assault, attempted suicide), FSD (sum of feeding, locomotion, expression, transfer mobility, and social interaction discharge scores for all non-fatal patients), and mortality. Multilevel mixed-effects logistic regression models and ordinal regression analyses using generalized linear mixed models assessed the impact of admission year on adjusted mortality and FSD score, respectively.

Results: Of the 337,208 patients presenting to Pennsylvania trauma centers from 2003-2012, 15,020 (4.6%) were GSW victims. Handguns were the most common mode of injury (n=5,345; 83.9%) among cases with specified firearm type (n=6,367). The majority of GSWs were coded as assaults (n=13,079; 87.1%), with suicide attempts accounting for the second-largest subcategorization (n=1,378; 9.2%). Law enforcement inflicted GSWs accounted for 1.4% of admissions (n=203). Suicide attempts were most prevalent in older white males, while assaults were more common in young black males. Rates of GSW hospitalizations significantly decreased over the study period (test of trend p=0.001). Admission year was associated with a decreased mortality trend (AOR: 0.98, 95%CI: 0.96-1.00; p=0.110) and decreased FSD (AOR: 0.98, 95%CI: 0.96-1.00; p=0.023) while controlling for demographics and injury severity.

Conclusion: Temporal trends in outcomes suggest rates of gun violence are declining in Pennsylvania and more patients are surviving their injuries. The decrease in functional status at discharge observed likely resulted from this improved survival, as patients dying in-hospital do not receive FSD scores.

	Mortality Model (n=15,020)		Functional Status at Discharge Model (n=11,532: non-fatal patients)	
Variable	Adjusted Odds Ratio (95% CI)	p-value	Adjusted Odds Ratio (95% CI)	p-value
Admission Year	0.98 (0.96-1.00)	0.110	0.98 (0.96-1.00)	0.023
Age	1.02 (1.02-1.03)	<0.001	0.98 (0.98-0.99)	<0.001
Systolic BP	0.98 (0.97-0.98)	<0.001	1.00 (0.99-1.00)	0.274
GCS	0.73 (0.72-0.74)	<0.001	1.15 (1.13-1.17)	<0.001
ISS	1.06 (1.06-1.07)	<0.001	0.94 (0.94-0.95)	<0.001
Intent (Suicide)	1.97 (1.57-2.47)	<0.001	0.59 (0.46-0.74)	<0.001
	AUROC: 0.95			

Poster # 85

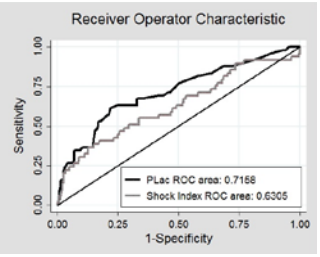
PREHOSPITAL LACTATE PREDICTS NEED FOR RESUSCITATIVE CARE IN NORMOTENSIVE TRAUMA PATIENTS

Alexander St. John MD, MS, Andrew McCoy MD, MS, Allison Moyes MD, Francis X. Guyette MD, MPH, Eileen Bulger* MD, Michael Sayre MD, University of Washington

Introduction: The prehospital decision of whether to triage a patient to a trauma center can be difficult. Traditional decision-making rules are based heavily on vital sign abnormalities, which have been shown to be insensitive in predicting severe injury. Prehospital lactate (PLac) measurement could better inform the triage decision. PLac's predictive value has been demonstrated in relatively severely injured patient populations but not in the broad population of all trauma patients transported by an advanced life support (ALS) unit.

Methods: This was a retrospective cohort study of all trauma patients transported by ALS units over a 14-month period. Data were obtained from an existing Resuscitation Outcomes Consortium database and our institutional trauma registry. Hypotensive patients were excluded, as they had already been analyzed in a separate study. PLac levels taken at time of intravenous line placement were analyzed using a point-of-care device. In the primary analysis, we measured PLac's ability to predict need for resuscitative care (RC) and compared it to that of shock index (SI). Need for RC was defined as either death in the emergency department (ED), disposition to surgical intervention within 6 hours of ED arrival, or receipt of 5 units of red blood cells within 6 hours. In a secondary analysis, the risk associated with increases in PLac was calculated.

Results: Among 314 included patients, the area under the receiver operator characteristic curve (AUROC) for PLac predicting need for RC was 0.716, which was significantly higher than that for SI (0.631) (p=0.125). PLac ≥ 2.5 mmol/L had sensitivity of 74.5% and specificity of 53.4%. The odds ratio for need for RC associated with a 1-mmol/L increase in PLac was 1.29 for PLac < 2.5 mmol/L (p=0.666), 2.27 for PLac from 2.5 to 4.0 mmol/L (p=0.027), and 1.26 for PLac ≥ 4 mmol/L (p=0.011).



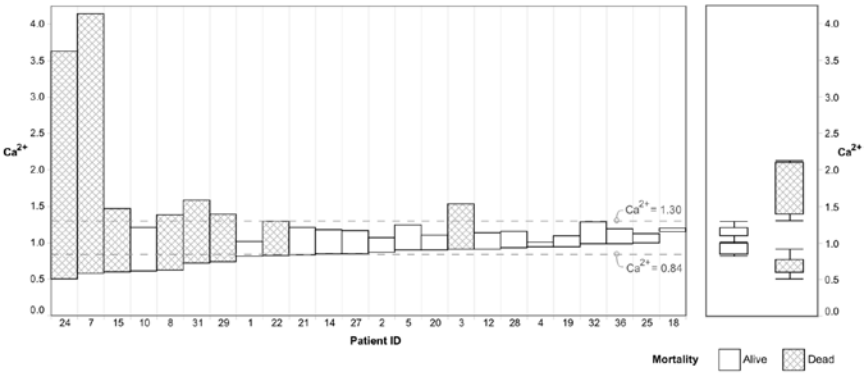
Conclusion: PLac measurement was strongly predictive of need for RC with adequate sensitivity in this normotensive trauma population. Prospective validation should be a focus of future investigation.

Poster # 86

RESUSCITATION HYPOCALCEMIA AND OVER-CORRECTION SHOULD BE AVOIDED IN SEVERELY INJURED PATIENTS

Emily J. MacKay DO, Michael Stubna Ph.D., Brian P. Smith MD, Lewis J. Kaplan* MD, Mark J. Seamon* MD, Daniel N. Holena* MD, Patrick M. Reilly* MD, Jeremy W. Cannon* MD, University of Pennsylvania

Introduction: Hypocalcemia on admission predicts both massive transfusion and mortality in severely injured patients. However, the effect of hypocalcemia that develops during resuscitation and the effect of subsequent calcium repletion remain unexplored. We hypothesize that any hypocalcemia and any over-correction of hypocalcemia in the first 24 hours after severe injury is associated with increased mortality.
Methods: All patients at our institution for whom the massive exsanguination protocol (MEP) was activated from January to December 2014 were identified. Patients transferred from another hospital, those not transfused, those with no ionized calcium (iCa2+) measured, and those who expired in the trauma bay were excluded. Hypocalcemia and over-correction were defined using the normal range of iCa 2+ at our institution, 1-1.25 mmol/L. ROC analysis (Younden's index) was also used to further examine significant thresholds for both hypocalcemia and over-correction. Hospital mortality was compared between groups. Secondary outcomes included need for ACLS, volume of blood products, and amount of calcium given.
Results: MEP was activated for 38 patients of whom 14 were excluded leaving 24 for analysis. Hypocalcemia occurred in 23 (96%) patients, and of these 9 (39%) were over-corrected. Mortality was no different in hypocalcemia vs no hypocalcemia (35% vs 0%, p=0.47) but was greater in over-correction vs no over-correction (89% vs 0%, p<0.001). ROC analysis indicated inflection points in survival outside of an iCa2+ range of 0.84-1.30 mmol/L (Figure). Using these values, 9 (39%) had severe hypocalcemia with a 78% mortality (vs 7%, p<0.001), and 7 (30%) had extreme over-correction with a 100% mortality (vs 6%, p<0.001). Severely hypocalcemic and extreme over-corrected patients also received more red blood cells, plasma, platelets and calcium repletion.
Conclusion: Hypocalcemia and calcium over-correction occur commonly during the initial resuscitation of severely injured patients with lethal injuries. Mild hypocalcemia may be tolerable, but more severe hypocalcemia and over-correction should be avoided. Further analysis to determine the optimal approach to calcium management during resuscitation is warranted.



Poster # 87

RESUSCITATIVE ENDOVASCULAR OCCLUSION OF THE AORTA (REBOA) CAN BE ALTERNATIVE TO AORTIC CROSS CLAMP IN ADULT TRAUMA PATIENTS REQUIRING TORSO SURGERY –A PROPENSITY SCORE MATCHING ANALYSIS

Atsushi Shiraishi MD, Ph.D., Junichi Inoue MD, Yasuhiro Otomo* MD, Ph.D., Masayuki Yagi MD, Tokyo Medical and Dental University

Introduction: Retrospective studies based on a propensity-score-matching analysis previously warned that use of resuscitative endovascular occlusion of the aorta (REBOA) against non-compressive torso hemorrhage might be dangerous in comparison of those without REBOA (Norii et al. J Trauma Acute Care Surg. 2015, Inoue et al. J Trauma Acute Care Surg. 2016). However, questions remain; Whether the subjects needed REBOA were basically comparable to those without REBOA or not, or, furthermore, whether REBOA could be alternative to aortic cross clamp (ACC) procedure or not. The study purpose was to compare mortality of surgically treated torso trauma subjects who underwent REBOA, ACC or neither of them.

Methods: This study was designed as a multicentered retrospective cohort study based on a non-binary propensity-score-matching analysis across 3 groups. Adult (≥16 y) trauma patients who underwent any torso surgery were selected from the Japan Trauma Databank through the year of 2004 to 2014 after the multiple imputation (25 datasets) for missing values in all the study variables. Patients were excluded if they had systolic blood pressure at presentation of 0 mmHg, heart rate at presentation of 0 /minute, or the unsurvivable injury under the definition of the abbreviated injury scale, or underwent both REBOA and ACC. A propensity score was computed of mechanism of trauma, pretreatment physiological status and AIS. A propensity score matching extracted baseline-characteristics-adjusted subjects who underwent REBOA, ACC or neither of them. The study outcome was defined as hospital mortality and was assessed between the groups.

Results: Out of a total of 11969 subjects eligible to the study selection criteria, 572, 229 and 11168 subjects underwent REBOA, ACC or neither of them (control). A propensity score matching extracted each of 174 subjects for REBOA, ACC and the control group, respectively, and those mortality during hospitalization were 66%, 87% and 43%, respectively. Aortic occlusion with REBOA or ACC was associated to excess hospital mortality in comparison of the control (OR 1.40, 95%CI [1.29, 1.51], P<0.001). Use of REBOA was associated to lower hospital mortality in comparison of that of ACC (OR 0.81, 95%CI [0.75, 0.89], P<0.001).

Conclusion: Aortic occlusion with REBOA or ACC before torso surgery in comparison of non-occlusion was associated to excess in-hospital mortality. It is concerned that subjects who requires aortic occlusion may be heterogeneous to those do not undergo these procedures. If so, this study advocated that REBOA might be superior to ACC in terms of hospital mortality and warranted future efficacy trials to test REBOA versus ACC in surgically treated torso trauma patients.

Poster # 88

PERITONEAL RESUSCITATION MITIGATES CRYSTALLOID RESUSCITATION INJURY AND ENHANCES THE VISCERAL PROTECTIVE EFFECTS OF PLASMA RESUSCITATION FOLLOWING HEMORRHAGIC SHOCK

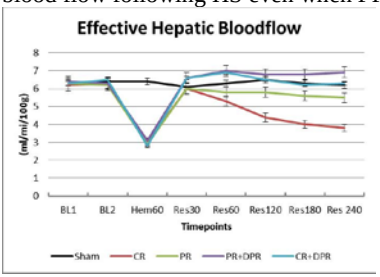
Jason W. Smith* MD,Ph.D., Jessica Weaver MD, Sam Matheson BS, Brian G. Harbrecht* MD, R N. Garrison* MD, Paul J. Matheson Ph.D., University of Louisville

Introduction: The use of plasma-based resuscitation (PR) following hemorrhagic shock (HS) has been associated with a decrease in mortality. Prior investigations have demonstrated that the use of PR can reduce systemic inflammation. We hypothesize that utilizing PR following hemorrhagic shock will enhance visceral blood flow (VBF) and reduce intestinal injury and inflammation.

Methods: Utilizing a validated model of HS, rats were randomized to compare crystalloid resuscitation (CR) of shed blood plus 2 volumes of LR, plasma based resuscitation (PR)of shed blood plus one volume of frozen plasma, and both CR and PR resuscitation augmented via peritoneal resuscitation (DPR). Galactose clearance was used to evaluate VBF. Pathology graded H&E, immunohistochemistry staining, and m30/m65 caspase cleave fragment analysis evaluated intestinal injury. Serum intestinal fatty acid binding protein (iFABP), LPS, and cytokines were used to evaluate systemic inflammation. All data are presented as mean ± SEM. Results were analyzed by 1-way analysis of variance with Tukey post hoc tests.

Results: Plasma resuscitation (PR) enhanced VBF over CR alone; however the administration of DPR enhanced VBF in both resuscitation models.(Figure 1) PR animals had reduced necrosis ([m65 fragment –m30 fragments] U/L:185±18 vs. 236±25, $p<0.03$) compared to CR but PR animals treated with DPR had reduced necrosis compared to PR alone (DPR:157±18 vs 185±18; $p<0.043$). CR alone treated animals had a worse ilieal injury (histology grade) compared to either PR animals or DPR treated animals. Serum TNFa, iFABP, and Il-6 at 4 hours post resuscitation were reduced in the PR animals vs CR animals alone, while LPS levels were not significantly different. Both CR and PR animals treated with DPR had reduced TNFa, iFABP, LPS and IL6 levels compared to PR alone.

Conclusion: PR enhanced visceral blood flow and reduced ileal injury following HS compared to CR alone. DPR appears to mitigate the injury associated with crystalloid resuscitation and enhance visceral blood flow and reduce systemic inflammation even further in the PR treated groups indicating that further research into augmenting visceral blood flow following HS even when PR is utilized is warranted.



Poster # 89

MULTI-INSTITUTIONAL ANALYIS OF NEUTROPHIL TO LYMPHOCYTE RATIO IN PATIENTS REQUIRING MASSIVE TRANSFUSION PROTOCOL; A NEW MORTALITY PREDICTOR VALUE

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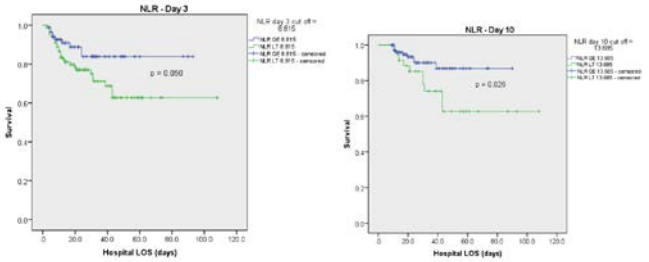
Introduction: In a recent single institution analysis the neutrophil/lymphocyte ratio (NLR), a marker of inflammation was associated with increased mortality in critically ill patients. The purpose of this study was to determine the relationship between NLR and outcomes in patients requiring the initiation of a Massive Transfusion Protocol (MTP). We hypothesized that the NLR would be a prognostic indicator of mortality in MTP patients.

Methods: This was a multi-institutional retrospective cohort study of adult trauma patients (≥18 years of age) who received MTP between November 2014 - November 2015 was performed. Differentiated blood cell counts obtained at day 0, 3 and 10 were used to obtain NLR. Receiver operating characteristic (ROC) curve analysis was used to assess the predictive capacity of NLR on mortality. To identify the effect of the NLR on survival, Kaplan-Meier survival analysis and Multivariable Cox proportional hazard model was used.

Results: A total of 285 MTPs were analyzed from 9 participating institutions. Patient demographics were {median(IQR)}: Age 35(25-47), ISS 25(16-36), GCS 9(3-15), blunt trauma 57.2%, male 80%. Using the ROC curve analyses at ICU days 3 and 10, optimal NLR cut-off values of 8.81 and 13.68 were calculated by maximizing the Youden index. KM curves at day 3 (p=0.05) and day 10 (p=0.02) revealed a NLR greater than or equal to these cut-off values as a marker for increased in-hospital mortality. (Blue line is value below cut point; green line is value above cut point)



Cox regression models failed to demonstrate a NLR over 8.81 as predictive of in-hospital mortality at day 3 (p= 0.056) but predictive for mortality if over 13.68 at day 10 (p=0.03).

Conclusion: This is the first multi-institutional analysis that correlates NLR, a marker of inflammation as an early mortality predictor in MTP patients. Further research should focus on factors that can help ameliorate NLR's in this patient population is needed.

Poster # 90

A Geriatric Trauma Service: are there perks?

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Introduction: Management of the elderly trauma patient poses several challenges including chronic conditions that may confound conventional treatment. The geriatric trauma patient is known to have poorer clinical outcomes when compared to their younger counterpart irrespective of injury severity score (ISS). In recognition of the above, trauma centers across the nation have begun to develop specialized Geriatric Trauma Services to manage this population. In 2009, our trauma center developed a G60 (≥ 60 years) Trauma Service. The G60 trauma service consists of a multi-disciplinary team (internal medicine, surgical sub-specialist, physical therapy etc.) lead by the trauma surgeon. Here we present our 5 year experience with the G60 Trauma Service.

Methods: The Trauma Registry was queried for all patients ≥ 60 years managed between January 1 st, 2006 and December 31st, 2014 after IRB approval. The G60 program was implemented on August 1st, 2009. Patients were divided to pre-august 2009 as non-G60 (**nG60,** n=694) and post-august 2009 as G60 (**G60,** n=2,011) program. Patient demographics (age, sex), injury parameters (cause of injury, ISS), clinical outcomes (ICU length of stay – ILOS, hospital length of stay – HLOS, discharge disposition and mortality), and trauma patients transferred to our hospital were recorded. Impact of variant ISS between **nG60** and **G60** was corrected by dividing HLOS and ILOS by ISS prior to statistical analysis to produce rHLOS and rILOS.

Results: Patient demographics show an average age of 75 ± 10 y/o with 59% female and 40% male for the two groups. The cause of injury was 77% fall, 18% motor vehicle crash (MVC) and 5% other. No statistically significant variation is noted in demographics. Multi-disciplinary management has allowed for a significant (p-value: 0.0006) reduction in rILOS from in the **nG60** and **G60**. Unfortunately, no statistically significant (p-value: 0.018) reduction in rHLOS was noted between **nG60** and **G60** group. However, **nG60** patients have poorer clinical outcomes with 3.4x more likely to be discharge to long term acute care facilities. Contrarily, **G60** patients were 2x-1.4x more likely to be discharge to assistance facilities (including nursing homes and rehabilitation facilities). Mortality was significantly (p-value: 0.0001) higher in the **nG60** (8%) relative to **G60** (5%) group. Finally, a statistically significant (p-value: <0.01) increased in trauma patients transferred to our hospital seen after the implementation of the **G60** (23%) program relative to **nG60** (12%).

Conclusion: Long term benefits of the G60 program are based on the multidisciplinary management of patients. A reduction in rILOS, improved discharge disposition and decreased mortality were noted irrespective of ISS for the **G60** group. Additionally, an influx in patients is noted with the implementation of the G60 program. The Committee on Trauma should consider incorporating the G60 trauma service as an essential requirement for the designation of a Level II or I trauma center.

Poster # 91

ARE NARCOTIC PRESCRIPTIONS ACTUALLY FILLED FOR INJURED CHILDREN? FINDINGS GLEANED FROM A STATEWIDE PRESCRIPTION MONITORING PROGRAM.

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Introduction: Injured children frequently receive narcotic prescriptions at the time of hospital discharge, yet the proportion of patients who fill those prescriptions is not known. Our state recently mandated a statewide electronic prescription monitoring program (PMP) which offers an opportunity to better understand narcotic usage after trauma.

Methods: Admitted trauma patients < 18 y.o. discharged home from an academic level 1 pediatric trauma center in 2014 were identified. Discharge pain medication prescriptions were abstracted from medical record and PMP queried for same patients. US Census Bureau data for median household family income (MHFI) by ZIP code tabulation area was identified for each patient. The associations between demographics, Injury Severity Score (ISS), and MHFI, and narcotic prescribing or filling was analyzed.

Results: Of 256 injured children discharged home, 63% received a narcotic prescription. Of those prescribed a narcotic, 63.4% filled the prescription.

	Prescribed, % (p)	Filled, % (p)
Male v. Female	64 v. 62 (NS)	65 v. 59 (NS)
White v. Non-white	64 v. 60 (NS)	66 v. 58 (NS)
Hispanic v. Non-Hispanic	56 v. 65 (NS)	47 v. 67 (.04)
ISS <4 v. ISS >4	59 v. 67 (.21)	54 v. 73 (<.01)
Surgery v. None	90 v. 43 (<.0001)	78 v. 40 (<.0001)
Age in years <1, 1-2, 3-5, 6-12, >12	22, 54, 66, 74, 71 (<.0001)	50, 48, 48, 64, 78 (.03)
MHFI in quartiles 1, 2, 3 4	63, 51, 55, 52 (NS)	48, 67, 70, 44 (NS)

Logistic regression showed increased adjusted odds ratios for prescription filling for age ≥6 y.o. (1.4, 95%CI 1.029-1.991), ISS > 4 (2.2, 1.02-4.554), or surgical procedures (5.3, 2.496-11.185), but not for gender, race, ethnicity, or MHFI.

Conclusion: A significant proportion of narcotic prescriptions given to injured children at hospital discharge go unfilled, especially for the very young. Those with minor injuries (ISS <4) received narcotics prescriptions at the same rate as those with more severe injuries. It is unclear if nonfulfillment represents over-prescribing by practitioners or under-utilization by parents. We did not find a strong correlation between population-based socioeconomic factors (MHFI) and either prescribing or filling narcotics. In light of the national epidemic of prescription narcotic misuse, the causes of the discrepancy between narcotic prescribing and filling warrants prospective review, as does the correlation between prescription filling and narcotic use.

Poster # 92

CHILDREN WITH SEVERE TRAUMATIC INJURIES FARE BETTER WHEN MANAGED AT PEDIATRIC TRAUMA CENTERS

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Introduction: With advancements in traumatology, pediatric trauma emerged as a different entity. Recently there has been a push towards development of dedicated pediatric trauma centers and preferential triage of pediatric trauma patients to these centers. The aim of this study was to assess the difference in outcomes of pediatric and adult trauma centers in the management of severely injured pediatric trauma patients and assess factors contributing to these differences.

Methods: We performed a two-year (2011-2012) analysis of National Trauma Databank. We included all pediatric patients (age <18 years) who were severely injured (ISS>15). Patients with no vital signs at presentation, transferred to another hospital, and missing data on primary outcomes were excluded from the analysis. Patients were stratified into two groups: presenting at a pediatric trauma center versus presenting at an adult trauma center. Primary outcome was emergency department (ED) and in-hospital mortality. Missing data was accounted for by using missing value analysis and multiple imputation technique. Binary logistic regression was performed.

Results: A total of 14,906 patients were included in the analysis. Mean age (SD) was 12.5 (5.4), median ISS (IQR) was 22 (17-27), 67% were male, and 46% were treated at a pediatric trauma center. Overall in–hospital mortality (8.2% vs. 10.3%, $p<0.001$) and ED mortality (1.9% vs. 4%, $p<0.001$) was significantly lower in children managed at a pediatric trauma center. In children with penetrating trauma ED mortality was lower in pediatric trauma centers (6.3% vs. 12%, $p<0.001$), however there was no difference in overall mortality (20% vs. 21%, $p=0.6$). On regression analysis, after controlling for age, gender, ISS, hemodynamic instability at the scene or during transport, and transit time from injury to ED, Pediatric trauma centers were associated with 20% reduction in overall (OR [95% CI]: 0.8[0.7-0.9], $p=0.003$) and 45% reduction in ED mortality (OR [95% CI]: 0.55[0.4-0.7], $p<0.001$).

Conclusion: Pediatric trauma centers provide a dedicated team of trauma professionals with extended resources for children presenting with trauma. The results of our study suggest that even after controlling for transit time, hemodynamic instability at the scene pediatric trauma centers confer a significant reduction in mortality.

Poster # 93

When is a Rib Fracture Not Just a Rib Fracture? Implications of Rib Fractures in Pediatric Trauma Patients

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Introduction: Due to their highly elastic nature, rib fractures in children are thought to be an indicator of significant injury and are believed to be associated with high rates of mortality and injuries to other body regions. Previous studies that have examined this issue were limited by small sample sizes. The goal of our study was to determine the association between rib fractures and mortality, abdominal injuries, and head injuries in children, and to compare these rates to those found within the adult population.

Methods: The National Trauma Data Bank was queried from 2008-2013 to compare patients with and without rib fractures. Subjects were categorized into four age groups: 0-10, >10-21, >21-60, and >60 years. Multivariate logistic regressions were used to test for association between rib fractures and outcomes after adjusting for demographics, mechanism, intent, and comorbidities.

Results: 212,459 patients were identified with rib fractures including 1,923 children <10 years and 15,641 children ages >10-21 years. Children <10 years with rib fractures had a mortality of 7.6%, and were found to have an increased risk of mortality, abdominal solid organ injury, head injury, and need for abdominal procedure compared to children without rib fractures (Table 1).

Table 1: Outcomes for children ≤10 years with rib fractures compared to children ≤10 years without rib fractures

Outcomes	Estimate	95% CI	P-Value
Mortality	3.88	(3.22, 4.69)	<.0001
Abdominal solid organ injury	7.54	(6.80, 8.37)	<.0001
Head injury	1.18	(1.08, 1.31)	0.0005
Number body regions AIS>2	1.53	(1.48, 1.59)	<.0001
Abdominal procedure	7.59	(4.94, 11.65)	<.0001

CI – confidence interval; AIS – abbreviated injury score

In children, there was no difference in mortality for multiple rib fractures compared to a single rib fracture (odds ratio = 1.44, 95% Confidence Interval = 0.93,2.25). Of note, compared to adults with rib fractures, children <10 years with rib fractures had higher rates of mortality, abdominal solid organ injury, and head injury (Table 2).

Table 2: Outcomes for children ≤10 years compared to adults >21-60 years with rib fractures

Outcomes	Estimate	95% CI	P-Value
Mortality	1.56	(1.29, 1.89)	<.0001
Abdominal solid organ injury	2.37	(2.14, 2.62)	<.0001
Head injury	1.35	(1.22, 1.49)	<.0001

CI – confidence interval

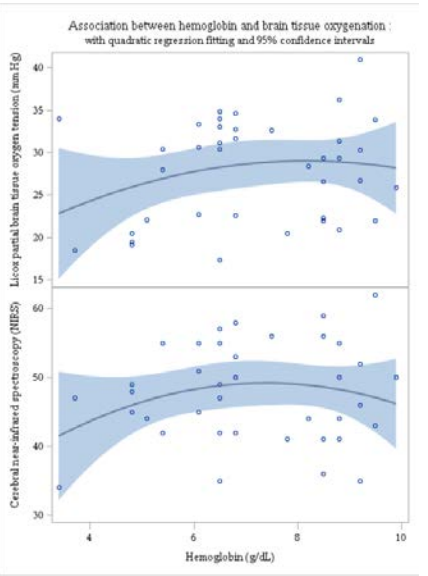
Conclusion: Rib fractures in children are associated with higher rates of mortality and injuries in other body regions compared to children without rib fractures and adults with rib fractures. These findings support that the presence of even a single rib fracture in a child should prompt further work-up for these associated injuries.

Poster # 94

Rethinking Transfusion Threshold to Maintain Brain Tissue Oxygenation in a Young Animal Model

Lori A. Gurien MD,MPH, Robert T. Maxson* MD, Steven C. Mehl BS, Kevin W. Sexton MD, Mallikarjuna R. Rettiganti Ph.D., Marie E. Saylors MPH, Jeffrey M. Burford MD, Arkansas Children's Hospital

Introduction: Mixed evidence exists regarding the benefit of red blood cell (RBC) transfusion in patients who sustain traumatic brain injuries (TBI). While some studies support RBC transfusion as a strategy to increase brain tissue oxygenation, other studies have demonstrated negative short and long-term effects following transfusion. The data is even more limited in children. We designed a pilot study to investigate the effects of anemia and RBC transfusion on brain tissue oxygenation in a young animal model.
Methods: Brain tissue oxygenation was measured in 7-week old pigs (N=4) using Licox brain tissue oxygen probes and cerebral near infrared spectroscopy (NIRS) monitors. Subjects underwent interval bleeding followed by volume replacement with plasma and/or crystalloid solution to maintain euvolemia. Hemoglobin levels were measured to correlate with brain tissue oxygenation. Vital signs and other lab values were also recorded. Subjects were transfused with RBCs after severe anemia developed. Multivariate linear regression models were used to test for association between brain tissue oxygenation and vital signs, pCO2, bicarbonate, pH, base deficit, and lactic acid.
Results: No significant relationship was found between hemoglobin and brain tissue oxygenation. There appeared to be a positive association seen when hemoglobin dropped below 7.5 g/dl (Figure). Above this value, there was no correlation between hemoglobin and brain tissue oxygenation. Brain tissue oxygenation was extremely sensitive to oxygen saturation. Deliberate induction of hypoxia demonstrated a decrease in partial brain tissue oxygen tension to 6.7 (high mortality risk) within several minutes. A multivariate linear regression model demonstrated that oxygen saturation ($p<0.001$) and lactic acid levels ($p<0.001$) were associated with brain tissue oxygenation, while hemoglobin ($p=0.076$) was not found to be significantly associated with brain tissue oxygenation after adjusting for vital signs and lab values ($R^2 = 0.596$).



Conclusion: Brain tissue oxygenation in a young animal model appears to be affected by anemia when hemoglobin falls below 7.5 g/dl suggesting that RBC transfusion above this level is unnecessary to maintain brain tissue oxygenation. Avoiding hypoxia appears to be more important in maintaining brain tissue oxygenation. Larger studies are needed to confirm these results. Further studies using this animal model can help formulate RBC transfusion guidelines in pediatric TBI patients.

Poster # 95

DISPARITIES IN ACCESS TO SPECIALTY CARE FOR CHILDREN WITH SEVERE BURNS

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Introduction: Pediatric burns require 120,000 emergency department visits and 10,000 hospitalizations annually. Burn centers specialize in burn treatment, from the initial assessment, resuscitation, and wound coverage, to rehabilitation; improving long-term quality-of-life in severely burned patients. The American Burn Association (ABA) has guidelines regarding which burns should receive treatment at a burn center; however there is geographic variation in the distribution of burn centers. Therefore, many children meeting ABA criteria are treated at non-burn hospitals. We hypothesized that disparity in access would be primarily related to resource availability and would not be affected by other factors.

Methods: Using weighted discharge data from the National Inpatient Sample 2001-2011, we identified pediatric patients with International Classification of Diseases-9th Revision (ICD-9) discharge codes for burn injury (940.0-949.5). ICD-9 codes, comorbidity data, and mechanism of injury codes were used to identify patients meeting ABA burn center treatment criteria. Burn centers were identified using the 2011 American Hospital Association Database. Data was restricted to states with a burn center. Using an Adjusted Wald test, age, gender, race/ethnicity, payer status, injury characteristics, hospital location, length of stay, number of procedures, and discharge disposition were compared for 49,133 pediatric patients meeting ABA criteria.

Results: Of patients meeting ABA criteria, 80.1% (n=39370) were treated at a burn center and 19.9% (n=9763) were treated at a non-burn hospital. Patients treated at a burn center were younger (5.6 vs. 6.8 years old; $p = 0.001$) and met a greater number of criteria than their counterparts at non-burn centers (1.51 vs. 1.37; $p < 0.001$). Sex and race did not vary between the two groups. Burn center patients compared to non-burn center patients were more likely to have Medicaid as their primary payer (52.2% vs. 47.4%; $p = 0.020$) and less likely to have private insurance (37.6% vs. 43.1%; $p = 0.027$). Burn center patients were more likely to have burns to the head, neck, and face (41.5% vs. 33.7%; $p < 0.001$) and burn injuries on multiple body regions (60.8% vs. 38.3%; $p < 0.001$). While treatment center did not vary by region (Northeast, South, Midwest, West), only 0.1% of burn center patients were treated at a rural hospital compared to 11.2% of non-burn center patients ($p < 0.001$). Both length of stay and number of procedures were significantly higher for patients treated at burn centers (7.0 vs. 4.7 days, $p < 0.001$ and 2.1 vs. 1.2 procedures, $p < 0.001$; respectively). There were no significant differences in discharge disposition between the two groups.

Conclusion: Our results suggest that 20% of the children for whom the ABA recommends burn center treatment do not receive recommended care. Over 10% of patients treated in non-burn hospitals were treated in rural hospitals, suggesting that distance to a burn center may be one reason why severely burned children are not transferred. Contrary to our predictions, our data suggests that in addition to geographic resource limitations, there may be some disparity in access to specialized burn care due to primary payer. Our findings of an increased proportion of patients with public vs. private insurance at burn centers compared to non-burn centers are similar to studies of trauma center utilization. While it appears that insurance status may impact the decision to transfer to a burn center for some children, this will require further study.

Poster # 96

ADOLESCENT MOTOR VEHICLE CRASH PREVENTION THROUGH A TRAUMA CENTER SPONSORED INTERVENTION PROGRAM.

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Introduction: While programs exist to educate teen drivers as to the perils of drunk and distracted driving, actual data supporting effective injury rate reduction of such is limited. We assessed the effectiveness of a hospital sponsored interactive risky behavior reduction program. This intervention was instituted for a four year period at a large area high school served by a single emergency response system and Level 1 Trauma Center.

Methods: Using our institutional trauma registry, we identified motor vehicle crash drivers with ages 16-21 and living in zip codes served only by the intervention high school and Trauma Center. The incidence of crashes involving these drivers was compared over two intervals, consisting of pre-intervention and post-intervention surveillance, each over a period of three years. Additionally, crashes involving the same age group from a demographically similar adjoining county served by a large high school that did not have the intervention were compared. Statistical comparisons were performed by Chi Square Analysis. The potential economic impact of any change of crash incidence was extrapolated using published data from the Web-based Injury Statistics Query and Reporting System (CDC WISQARSTM).

Results: During pre-intervention surveillance, the number of adolescent motor vehicle crashes from the isolated catchment area was 166. The number in the post-intervention period was 105. This represents a significant risk reduction of 37% ($P<0.05$). The crash incidence in the non-intervention control catchment area remained statistically unchanged during the same period. The study populations remained stable in both areas during surveillance. Extrapolating the economic impact of such a decrease in crash occurrences with published figures from CDC WISQARS TM date, the return on investment of our intervention was 16,600%, representing a decreased burden of cost of more than 3.3 million dollars.

Conclusion: Our results suggest that educational intervention programs strategically directed towards adolescent drivers have a significant impact on the incidence of motor vehicle crashes in such populations. The decrease in occurrences leads to a significant decrease in morbidity and mortality, as well as a reduction of healthcare economic burden.

Poster # 97

CASUALTY CARE IN THE CLASSROOM- HEMORRHAGE CONTROL FOR SCHOOL STAFF

Christopher Wistrom DO, Mike Blaser Thomas Brunner James MacNeal DO, Karen Schulte Greg Jones Special Agent FBI, Scott Meyers Chief Deputy Sheriff, Alissa DeVos MPAS, Todd Daniello MD, Sean Marquis MD,MPH, Rick Barney MD, Robb Whinney DO, John Pakiela DO, Rodney VanBeek MD, Krista Kimball MPAS Mercy Hospital And Trauma Center

Introduction: Significant resources are dedicated to "active shooter" response training for police, school officials, and EMS personnel; however, emergency medical personnel cannot treat the wounded until the scene is secured, which often takes significant time. Following a FBI school shooting tabletop scenario, a core group of physicians, law enforcement, EMS, fire, and school officials developed the Casualty Care in the Classroom course, a cost effective reproducible train the trainer program to increase readiness and competence of school staff to care for those immediately wounded. This study examines the immediate and long term effects of the Casualty Care in the Classroom course on its participants.

Methods: Standardized survey administered pre, immediately post and one year following training. All questions are asked on a 1-5 likert scale. Those surveyed include elementary, middle, and high school teachers and staff.

Results:

Percent of respondents that answered 'Agree' or 'Strongly Agree'

	prior to training (N=1594)	immediate post-training (N=493)	1 year post-training (N=297)
Do you know law enforcements role in a rapid response situation?	45.36%	93.32%	85.23%
Are you capable of helping and injured person?	77.32%	92.91%	92.41%
Do you know how to apply a tourniquet?	35.65%	93.93%	91.14%
Would you apply a tourniquet if you knew how?	82.64%	94.53%	93.67%
Do you know the procedure for dealing with a crisis in the building?	55.89%	81.38%	79.32%
Do you feel you are prepared for a crisis situation?	43.55%	80.57%	62.45%
Do you feel the school district is prepared for a crisis situation?	46.93%	77.94%	62.03%

Conclusion: The Casualty Care in the Classroom course successfully placed lifesaving skills and tools in the hands of school officials thereby building sustained confidence in personal and organizational response to a crisis situation.

Poster # 98

PREVENTING CONCUSSIONS WITH CORE MUSCLE TRAINING: A STUDY IN HIGH SCHOOL ATHLETES

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Introduction: Over the last 10 years sports related concussions have been a topic of extensive debate. While much of the emphasis of research has focused on timely diagnosis and treatment, there has been little reported on concussion prevention. The goal of this study is to examine the use of core training as a preventative tool for concussions in the high school athlete. We hypothesize that with increased core strength, an athlete will have more control of their body mechanics and the movement of their head and neck during a fall or collision, allowing them to reduce the whiplash mechanism that is often the cause of a concussion.

Methods: We performed a non-randomized prospective study involving high school athletes participating in football, soccer, and volleyball. During the fall of 2014, student athletes in grades 9-12 at a local high school participated in a ten-week training session with exercises in the following areas: mobility, agility, stability, strength and flexibility (MASSf). Exercises in each area were performed for a total of twenty minutes daily during the pre-season training sessions. Logs of all concussions diagnosed using ImPACT concussion testing were kept during the fall sports season. Statistical analysis was done using Chi-square to calculate expected/observed frequency and Chi-squared test statistic, x 2. Test significance was accepted at a $p<0.01$. The MASSf program was repeated in the 2015 season validating our primary results.

Results: 119 athletes participated in the 2014 pre-season MASSf training sessions and were subsequently monitored for concussions during the corresponding sports season. Utilizing 2010-2013 concussion data, or pre-MASSf data, the calculated expected number of concussions for 2014 was 10.87 (Table 1). With the addition of the MASSf program the observed incidence of concussions was reduced to 2. Using a chi-squared contingency test, our calculated test statistic, x 2=9.84, corresponds to a p-value of 0.0017 (Table 2). The MASSf program was repeated in the 2015 season with almost identical results, 2 concussions in 121 participants.

Conclusion: Our study showed a statistically significant decrease in concussion rates among high school athletes after participating in pre-season MASSf training. These results were then reproduced in the subsequent year. This supports the theory that strengthening core muscles correlates with a decreased risk of concussion. The MAASf program shows promise as a primary prevention method to reduce sports related concussions.

TABLE 1	Injured	Uninjured	Total
Expected			
Pre-MASSf	46.13	458.87	505.00
MASSf	10.87	108.13	119.00
	57	567	624
Observed			
Pre-MASSf	55	450	505
MASSf	2	117	119
	57	567	624

TABLE 2	Injured	Uninjured	Test Statistic
Pre-MASSf	1.17	0.17	1.88
MASSf	7.24	0.73	7.97
			9.84

Poster # 99

HISPANIC CHILDREN ARE LESS LIKELY TO RECEIVE REHABILITATION THAN NON-HISPANIC WHITE AND BLACK CHILDREN FOLLOWING TRAUMATIC INJURY.

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Introduction: Trauma remains a leading cause of pediatric morbidity and mortality in the US, accounting for over 150,000 deaths annually. Children who survive major injury often require some form of rehabilitation prior to regaining long-term functionality after hospitalization. While racial disparities are described in discharge destination following adult trauma, this has yet to be evaluated in the pediatric trauma population. We hypothesize that Hispanic and Black children are less likely to receive intensive rehabilitation as compared to non-Hispanic Whites.

Methods: Pediatric traumas (age $\lesssim$ 17 years) were evaluated using National Trauma Data Bank data from 2007-2012. Discharge destination was defined ordinally based on increasing intensity of rehabilitative services. Propensity-Score Weighting was used to balance observed pre-hospital covariates between race categories. Ordinal logistic regression was used to adjust for in-hospital characteristics and evaluate racial disparities within discharge destination.

Results: 461,238 pediatric traumas were analyzed, of which 330,430 incidents were included in the propensity-weighted analysis. Distribution by race was as follows: 221,130 (67%) were classified as non-Hispanic White, 50,605 (15%) Hispanic and 58,695 (18%) Black. Propensity weighting resulted in covariate balance. After ordinal logistic regression, Black patients were slightly more likely to be discharged to a higher level of rehabilitation than non-Hispanic Whites (adjusted OR=1.17 CI=1.11-1.23). However, Hispanic (adjusted OR=0.71 CI=0.66-0.76) patients were less likely to be discharged to a higher level of rehabilitation as compared with non-Hispanic Whites.

Conclusion: Hispanic pediatric trauma patients are significantly less likely to receive intensive rehabilitation than their non-Hispanic White counterparts and may represent a vulnerable population. In contrast, Black pediatric trauma patients are equally if not more likely to receive intensive rehabilitation as their non-Hispanic White counterparts. Differences in discharge disposition may be influenced by social, cultural, and economic factors as well as real, or perceived expectations on the part of clinicians and families. Unmeasured patient, physician and institutional factors contributing to this inequity must be identified in order to provide all injured children with the resources needed to achieve the best possible outcome following trauma.

Poster # 100

A STATEWIDE OVERVIEW OF PEDIATRIC SEVERE TRAUMATIC BRAIN INJURY 2003-2013: INCREASING CRANIECTOMY RATE WITH NO CHANGE IN OUTCOMES

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Introduction: Pediatric severe traumatic brain injury (sTBI) remains an area in need of further research. We sought to provide a statewide epidemiological overview of pediatric neurosurgical practice patterns and outcomes over an 11-year period in a mature trauma system. We hypothesized that increased rates of craniectomy, increased functional status at discharge (FSD), and decreased mortality would be observed.

Methods: All pediatric (<18 years old) isolated sTBI patients were extracted from the Pennsylvania Trauma Outcomes Study dataset from 2003-2013. Isolated sTBI was defined as a head Abbreviated Injury Scale (AIS) score ≥3 with a Glasgow Coma Scale (GCS) score ≤8 and all other AIS body region injury scores <3. Dead on arrival, transfer out, and penetrating trauma patients were excluded. Multilevel mixed effects logistic regression models assessed the adjusted impact of admission year on craniotomy, craniectomy, intracranial pressure monitor (ICP), and mortality rates while controlling for age, admission systolic blood pressure, GCS, Injury Severity Score (ISS), head AIS, and pediatric managing facility. A generalized linear mixed model analyzed the temporal trend in FSD (summed feeding, locomotion, expression, transfer mobility, and social interaction scores) for the non-fatal patient population while controlling for the same covariates.

Results: A total of 1,414 isolated sTBI pediatric patients presented over the study period. Intervention rates were 13% for craniotomy, 6% for craniectomy, and 18% for ICP. Overall mortality rate was 10% and the mean FSD score was 16.7±5.0. Admission year was associated with a 22% increase in craniectomy rate (AOR: 1.22, 95%CI 1.13-1.36; p<0.001) and a 6% increase in ICP (AOR: 1.06, 95%CI 1.01-1.11; p=0.016). No association was found between admission year and craniotomy rate (AOR: 0.98, 95%CI 0.93-1.04; p=0.516), mortality (AOR: 1.02, 95%CI 0.96-1.09; p=0.512), or FSD (AOR: 0.93, 95%CI 0.85-1.03; p=0.166).

Conclusion: While shifts in neurosurgical practice patterns were found over the 11-year study period, no improvements in outcomes were observed. Pediatric neurosurgeons must prioritize research identifying optimal management approaches to improve outcomes in the sTBI population.

	Mortality Model (n=1,414)		Functional Status at Discharge Model (n=1,270: non-fatal patients)	
Variable	Adjusted Odds Ratio (95% CI)	p-value	Adjusted Odds Ratio (95% CI)	p-value
Admission Year	1.02 (0.96-1.09)	0.512	0.93 (0.85-1.03)	0.166
Age	0.94 (0.90-0.98)	0.005	1.05 (0.98-1.13)	0.180
Systolic BP	0.98 (0.97-0.99)	<0.001	0.99 (0.98-1.01)	0.477
GCS	0.64 (0.56-0.74)	<0.001	1.23 (1.12-1.36)	<0.001
ISS	1.08 (1.05-1.12)	<0.001	0.75 (0.71-0.79)	<0.001
Head AIS	1.18 (1.00-1.40)	0.052	1.04 (0.78-1.38)	0.803
Pediatric Center	0.50 (0.26-0.98)	0.042	0.95 (0.34-2.72)	0.928
	AUROC: 0.85			

Poster # 101

RISK FACTORS FOR ACUTE RESPIRATORY DISTRESS SYNDROME FOLLOWING HEMORRHAGE: FINDINGS FROM THE PROPPR STUDY

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Introduction: The Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) study evaluated the effects of plasma and platelets on hemostasis and mortality during damage control resuscitation. The pulmonary consequences of resuscitation strategies that mimic whole blood remain unknown. We hypothesized that volumes of crystalloid and blood would be risk factors for ARDS following severe trauma with major bleeding.

Methods: Severely injured patients predicted to receive a massive transfusion were randomized to 1:1:1 vs. 1:1:2 plasma-platelet-RBC ratios at 12 level I North American trauma centers. Patients with survival >24 hours, an ICU stay, and a recorded PaO2/FiO2 (P/F) ratio were included for analysis. ARDS was defined as a P/F ratio <200 mmHg with bilateral pulmonary infiltrates on chest imaging and determined by case review by each site principal investigator. Data are expressed as medians and odds ratios (OR) [95% confidence interval]. Statistical significance is $p<0.05$.

Results: Of the 680 patients randomized, 454 patients were included in this subset analysis (230 received 1:1:1, 224 1:1:2). Age, sex, mechanism of injury, head, chest, abdomen and extremity abbreviated injury scale (AIS) scores did not differ between the groups. Volume of plasma and platelets given at 0-6 and 0-24 hours significantly differed, while RBCs and crystalloid did not. The lowest P/F ratio (173 vs. 156 mmHg) and highest PEEP (7 vs. 8 cm H2O) during the first 7 days and highest tidal volume during the first 2 days (7.9 vs. 7.9 mL/kg of predicted body weight) did not differ. No differences in ARDS rates (14.8 vs. 18.4%), ventilator-free (24 vs. 24) or ICU-free days (17.5 vs. 18), hospital length of stay (22 vs. 18 days), or 30-day mortality were found (28 vs. 28%). ARDS was associated with blunt mechanism of injury (OR 3.61 [1.53-8.81] $p<0.01$) and chest AIS score (OR 1.40 [1.15-1.71] $p<0.01$). Each 500 mL of crystalloid infused during hours 0-6 was associated with a 9% increase in the rate of ARDS (OR 1.09 [1.04-1.14] $p<0.01$, [Figure]). Blood products given at 0-6 or 7-24 hours were not risk factors for ARDS.

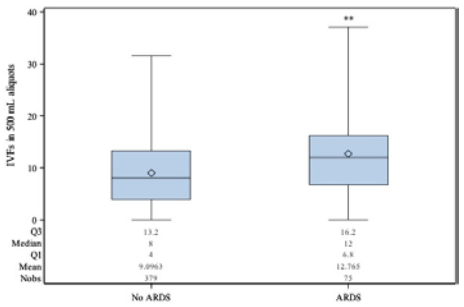

Figure: Crystalloid provided at 0-6 hours (**$p<0.0001$).

Conclusion: Acute crystalloid exposure, but not blood products, emerges as a modifiable risk factor for the prevention of ARDS following hemorrhage. Damage control resuscitation with plasma and platelet ratios that mimic whole blood does not appear to contribute to pulmonary morbidity.

Poster # 102

CONTRAST-ENHANCED ULTRASOUND: A NOVEL METHOD FOR BLOOD VOLUME ASSESSMENT IN HEMORRHAGIC SHOCK

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Introduction: Accurate estimation of circulating blood volume (CBV) is essential in patient management, but standard methods for measuring CBV are impractical in many critical situations. CEUS is a technique that makes use of contrast agents to enhance the echogenicity of blood, thereby improving the visualization and quantitation of blood volume (Miele V et al., Br J Radiol. 2016 Jan 8:20150823). We hypothesized that 3D contrast-enhanced ultrasound (CEUS) of intraabdominal sites could reliably estimate CBV in a rodent model of acute hemorrhagic shock.

Methods: Microbubbles were injected via tail vein catheter into 13 mice. 4 sites (diaphragmatic-hepatic, spleno-renal, cysto-colic, hepato-renal) were imaged using a contrast destruction/replenishment protocol, where contrast agent is acoustically destroyed in the field of view and the resultant acoustic signal is quantified as the tissue is replenished with contrast. After baseline imaging, 20% of the calculated CBV was withdrawn via right common carotid catheter. Following a 20 minute recovery period, microbubbles were re-injected and the 4 abdominal sites reimaged. After 20 minutes, mice were then resuscitated with saline to baseline CBV. Microbubbles were injected a third time, and the 4 sites reimaged post-resuscitation. Correlations between CBV and area under the replenishment curve (AUC) were analyzed using partial correlation coefficients controlling for ultrasound site.

Results: The calculated CBV positively correlated with the AUC at baseline, blood loss and post-resuscitation when controlled for ultrasound site. (Table)

Conclusion: 3D CEUS is feasible using abdominal windows similar to FAST. CBV can be accurately measured during acute blood loss and resuscitation.

Variables	Partial Correlation	p-value
Calculated Circulating Blood Volume (CCBV) and AUC Baseline Measurement	0.8330	<.0001
Total Blood Volume Loss (TBVL) (%) and AUC Blood Loss Measurement	-0.3524	0.0130
Calculated Circulating Blood Volume (CCBV) and AUC Blood Loss Measurement	0.6947	<.0001
Calculated Circulating Blood Volume (CCBV) and AUC Resuscitated Measurement	0.8040	<.0001

Poster # 103

MONOCYTE TISSUE FACTOR EXPRESSION CAUSES MICROCLOT IN DISTANT UNINJURED ORGANS AFTER TRAUMATIC SHOCK IN A MURINE MODEL

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Introduction: Tissue factor (CD142), a pro-coagulant protein of the extrinsic pathway, is mobilized during trauma primarily by upregulation of expression in monocytes. The consequences of this mobilization are unknown. We hypothesize that tissue factor mobilization in the setting of tissue injury and hemorrhage contributes to microvascular thrombosis in distant uninjured organs.

Methods: We developed a murine model of hemorrhage and pulmonary contusion to simulate trauma with hemorrhagic shock. To create a pulmonary contusion injury, anesthetized male C57/Bl6 mice were injured with a 50g mass dropped from 0.35m. Class II hemorrhage was induced by retro-orbital phlebotomy, removing 15% of the animal's blood volume. Animals were divided into 4 groups: sham (n=3), hemorrhage (n=2), contusion (n=3), and combined hemorrhage with contusion (n=4). Animals were sacrificed 6 hours after injury. Renal tissue was prepared for hematoxylin-eosin (H&E) staining and immunohistochemistry (IHC) for fibrin. Peripheral blood leukocytes were analyzed by flow cytometry for expression of CD142.

Results: Tissue factor mobilization by monocyte expression occurred with hemorrhage or injury. Flow cytometry (n=2 each group) demonstrated increased expression of CD142 by monocytes (mean±SEM) in the hemorrhage only (76.8%±13.5%), contusion only (89.4%±0.3%), and combined groups (76.7%±2.7%). Sham animals expressed CD142 on 47.5%±1.3% of monocytes. H&E staining of kidney sections demonstrated microvascular thrombosis in 2 of 4 animals that underwent combined hemorrhage with contusion, but not in any animals in the sham, hemorrhage only, or contusion only groups. This finding was corroborated by IHC staining for fibrin.

Conclusions: This murine model of trauma demonstrates early tissue factor mobilization after direct injury by pulmonary contusion, class II hemorrhage, and combined injury with hemorrhage. Additionally, some animals which underwent injury and hemorrhage developed renal microvascular thrombosis within 6 hours of injury. We propose that increased levels of circulating tissue factor together with the altered hemodynamics and inflammatory milieu of hemorrhagic shock contribute to microvascular clot deposition. Further studies are needed to establish a causal relationship between tissue factor mobilization and microvascular clot deposition, but this represents a potential mechanism for early end-organ injury in the setting of severe trauma.

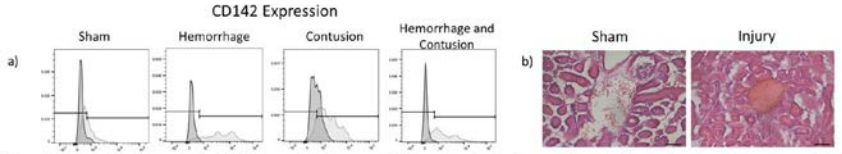

Figure 1: (a)Flow cytometry analysis of CD142 expression by monocytes in uninjured animals versus those with hemorrhage, contusion or a combined injury, expressed as fluorescence intensity by unit distribution. The dark population is an isotype control and the light population is the CD142 antibody. Both hemorrhage and contusion increase expression of CD142. Monocytes were gated by light scatter characteristics. (b) H&E staining of kidney sections after sham and combined hemorrhage with contusion. Renovascular thrombosis is present only in the combined hemorrhage with contusion model.

Poster # 104

INDICES OF INFLAMMATION AND OXIDATIVE STRESS FOLLOWING RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA) IN A SWINE HEMMORHAGE MODEL

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Introduction: Recent years have seen renewed interest in an endovascular approach to stem uncontrolled bleeding from the torso. Despite reported success of REBOA in both experimental animals and humans, concern has been raised about REBOA-induced lower body ischemia and an inflammatory response. The present study investigated indices of inflammation and oxidative stress in tissues above and below the balloon in hemorrhaged swine treated with REBOA under different protocols.

Methods: Sedated, spontaneously breathing adult male minipigs were hemorrhage 65% of estimated blood volume over 1 hr. They were then randomized to 4 groups (n=7/gp): 1) positive control (PC)- immediate return of shed blood, 2) R30- REBOA for 30 min, then return of shed blood and 3) R60 and 4) R60(30)- REBOA for 60 min but shed blood returned at 60 min or 30 min into the 60 min REBOA period. REBOA was performed using the ER-REBOA catheter (Prytime Medical Devices Inc, Boerne, TX). Pigs were monitored for 4 hr after hemorrhage, euthanized and lung, heart, liver, jejunum and kidney were collected and assayed for cytokines and indices of oxidative stress.

Results: The 65% hemorrhage model was 78% lethal with an average survival time of 81 min, whereas all REBOA animals survived the 4 hr experimental period. Tissues above the balloon (lung and heart) and below the balloon (liver, kidney, jejunum) were assayed at the end of the 4 hr experiment. No significant elevations in heart or lung cytokines were observed in any REBOA group compared with PC except a slight elevation in lung R60 TNF-α compared with PC. In contrast, significant elevations (2 to 9 fold) in liver and kidney R60 IL-6, liver R60 IL-1β and jejunal R60 TNF-α were observed compared with PC. In addition there were no significant differences in heart or lung total antioxidants, reduced glutathione (GSH), nitric oxide (NO) or NAD/NADH ratio among the REBOA groups compared with PC. In liver and kidney, 50% reductions in R60 GSH concentrations were observed compared with PC. Liver R60 NO was elevated and total antioxidants and glutathione reductase activity was about 20% lower than in PC. Kidney R60 Mn superoxide dismutase activity was 55% higher than PC. Generally, there were no significant differences in R60(30) indices measured, compared with R60 in any tissue.

Conclusion: The results of this study indicate that the heart and lung were not affected by up to 60 min REBOA. In contrast a significant inflammatory response and oxidant stress were detected in ischemic tissues after 60 min balloon occlusion compared with tissues from the PC group. Although not significant results suggested that return of shed blood at 30 min ameliorated these responses somewhat. Studies are underway to reduce lower body ischemia associated with REBOA.

Funded in part by US Army Medical Research Materiel Command

Poster # 105

TRANSFUSIONS INCREASE THE RISK OF EVERY NSQIP POST-OP OCCURRENCE: ANALYSIS FROM A STATE COLLABORATIVE

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Introduction: The value of red blood cell blood transfusion (BT) by a risk benefit analysis has not been fully elucidated. Balancing questionably increased oxygen carrying capacity to organ system, immunosuppressive and infectious complications is necessary. Because these unfavorable effects are often attributed to other processes, the association to BT is often insidious or ignored, even with prospective data. Despite restrictive practice guidelines, BT remains frequent, especially in surgical patients. We studied the effect of BT on a large surgical population to determine their effects on outcomes.

Methods: Using our Statewide collaborative NSQIP database, we looked at general and vascular cases over one year and calculated the relative risk of NSQIP post-operative occurrences (POC) for cases with BT compared to those without. The marginal effect of BT on the probability of postoperative occurrences was also evaluated to determine possible causal impact. The collaborative captures about 50% of cases done in the state by over 750 surgeons and the member hospitals range from rural facilities to university sites.

Results: From October 2014 to September 2015, 23,229 cases were entered into the database, 1443 had BT. BT patients had a statistically significant increase in relative risk (RR) with all 18 POC, (range 1.92 for superficial surgical site infection to 13.75 for renal failure). Table 1 highlights the POC with the largest RR. Deriving probabilities of a POC, BT, directly contributed significantly in mortality, need for CPR (CPR), Ventilation
>48 hours (V>48), pneumonia, sepsis and septic shock and unplanned intubation (UI).

Table 1. (UCL= upper control limit, LCL=Lower control limit)

POC	Renal fail	V>48	Septic Shock	CPR	Death	UI	Renal injury
RR	13.75	12.20	11.71	10.60	8.57	8.48	6.13
UCL	21.30	15.58	16.34	14.95	10.50	10.87	9.32
LCL	8.84	9.53	8.35	7.48	6.97	6.58	3.95
Cases	41	119	64	58	148	99	32

Conclusion: Red blood cell transfusion is associated with an increased RR for all NSQIP POCs and has a direct causal relationship with seven. These factors should be considered in the risk-benefit discussion and decision when ordering transfusions in surgical patients.

Poster # 106

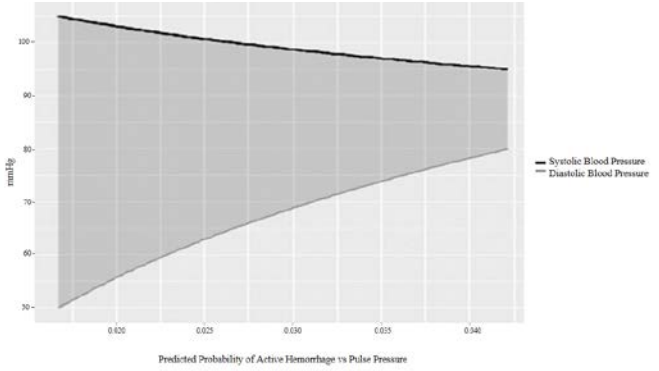
PULSE PRESSURE AS AN EARLY WARNING OF HEMORRHAGE IN TRAUMA PATIENTS

Erika M. Priestley BS, Kenji Inaba* MD, Saskya Byerly MD, Subarna Biswas MD, Monica D. Wong MS, Elizabeth Benjamin MD,Ph.D., Lydia Lam MD, Demetrios Demetriades* MD, Ph.D., Department Of Surgery, LAC+USC Medical Center, University Of Southern California

Introduction: Hypotension based on low systolic blood pressure (SBP) is a well documented indicator of ongoing blood loss. However, the utility of pulse pressure (PP) for the detection of hemorrhage has not been well-studied. The purpose of this study was to determine whether a narrowed PP in normotensive patients is an independent predictor of Critical Administration Threshold (CAT+) hemorrhage requiring surgical or endovascular control.

Methods: Retrospective single-center study (01/2010-10/2014), including trauma patients ≥16 yo with SBP≥90 mmHg upon emergency department (ED) admission. We identified patients that were both CAT+ (3 units pRBC/60 minutes within 24 hours of admission) and required interventional radiology (IR) or surgery for definitive hemorrhagic control. These patients were labeled Active Hemorrhage (AH). Univariate analyses compared demographic data, clinical interventions and in-hospital outcomes between the AH and non-AH patients. Stepwise logistical regression identified independent predictors for AH.

Results: Out of 18,015 trauma patients with normal SBP, 283 (1.6%) met the criteria for clinically significant hemorrhage. Patients were predominantly male (74.4%) with mean age 43.1±19.5, median Injury Severity Score (ISS) 5 (IQR:2-10) and median Glasgow Coma Scale (GCS) 15 (IQR:15-15). Mean PP was significantly lower in the AH compared to non-AH group (39±18 vs 53±19, p<0.0001). Multivariate analysis revealed that narrowed initial ED PP is an independent predictor of AH (AOR 0.975) along with increased age (AOR 1.01), penetrating mechanism (AOR 9.476), lower field SBP (AOR 0.985), increased ED heart rate (AOR 1.024), and increased ISS (AOR 1.136). Adjusted PP means were 61±10 in patients over age 60 years vs 51±11 in younger patients after adjusting for covariates of sex, age, race and weight, p<0.0001. Regression analysis identified a significantly higher risk of AH at a PP cutoff ≥ 55mmHg (AOR 3.44, p=0.005, AUC 0.955) in patients≥ 61 yo and 40mmHg (AOR 2.73, p<0.0001, AUC 0.940) for patients 16-60 yo. Predicted probability of AH increases as PP narrows (see Figure).



Conclusion: In patients who are normotensive in the resuscitation bay, narrowed PP is an independent predictor of active hemorrhage requiring blood product transfusion and intervention for hemorrhage control.

Poster # 107

EARLY ABG IMPROVES VENTILATOR MANAGEMENT IN PATIENTS WITH HEMMORHAGIC SHOCK

Scott M. Moore MD, Kiran U. Dyamenahalli Ph.D., Clay C. Burlew* MD, Fredric M. Pieracci* MD, Carlton C. Barnett* MD, Eric M. Campion MD, Charles J. Fox* MD, Walter L. Biffl* MD, Ernest E. Moore* MD, Jeffrey L. Johnson* MD, Denver Health Medical Center

Introduction: Hemorrhage is the leading cause of early postinjury death. Control of bleeding is hindered by postinjury coagulopathy, which arises from the synergistic effects of acidosis, hypothermia, and coagulopathy ("bloody vicious cycle"). In addition to restoration of intravascular volume, prompt respiratory support to prevent hypoventilation is considered essential. On the other hand, recent prehospital studies suggest positive pressure ventilation has detrimental effects in shock states. Whether purposeful hyperventilation to offset metabolic acidosis in an effort to restore blood pH to physiologic values leads to improved outcomes is not known. We hypothesized that early recognition of acid-base disturbances leads to earlier implementation of optimal minute ventilation, which would then lead to earlier correction of acidemia and improved lactate clearance.

Methods: Patients requiring emergent (<1 hour from arrival) non-neurosurgical operative intervention were identified at a regional, academic level I trauma center. A set of patients requiring a massive transfusion protocol (MTP) was also examined. Patients with an ER-drawn arterial blood gas (Early ABG) were compared to those in whom ABG was not done until after arrival in the OR (Late). Endpoints included time to optimal (>10 L/min) ventilation, correction of acidemia, and lactate clearance. All statistical comparisons were made using student t-test.

Results: 148 patients over an 18-month period met entry criteria. Overall mortality was 29.0%, with an average injury severity score (ISS) and initial pH of 26 ± 7.2 and 7.21 ± 0.02, respectively. Among acidemic patients (pH<7.25), there was a significant intraoperative delay in instituting a high V E strategy in the late ABG group (62.3±10.4 min) compared to those with an early ABG (29.3 ± 8.12 min, $P < 0.05$). Only 16.7% of patients with an ER-drawn ABG were started on high V E settings compared to 4.3% of patients with a late ABG. In contrast, there was no apparent delay in instituting a high VE strategy in MTP with late ABGs. That being said, only 20.8% of patients in this subset were started on high V E settings. Hypercarbia was present on the initial ABGs of 56.8% of MTP patients overall and 72.2% of acidemic MTP patients. Among MTP patients with an ER-drawn ABG and an initial arterial pH above 7.2, we found that 81.8% had worsening of their acidosis on follow-up intraoperative ABG, all of which were at least partially due to worsening hypercarbia. There was a non-significant trend towards improved lactate (mmol/L) clearance (decrease by 2.83 ± 1.3 vs. 1.4 ± 1.2, $P = 0.2$) and shorter time (min) to correct pH to above 7.25 (90.3 ± 15.1 vs. 128 ± 31.5, $P = 0.15$) in MTP-patients managed intraoperatively by high V E strategy.

Conclusions: Relative hypercarbia was a frequent finding in patients with hemorrhagic shock. Injured patients requiring emergent operative intervention were given high V E faster when an early ABG was performed. Massively hemorrhaging and acidemic patients received similar ventilator management regardless of the ABG timing, and an ER-drawn ABG that shows pH>7.2 may lead to inappropriately low initial V E settings. Though a trend towards improved lactate clearance and correction of acidemia exists for high VE strategy, further investigation is needed.

Poster # 108

SPECTRAL ANALYSIS OF HEART RATE VARIABILITY IN A SWINE HEMORRHAGE MODEL REVEALS MARKERS OF MORTALITY

Kiavash R. Koko MD, Brian D. McCauley BS, John P. Gaughan Ph.D., John M. Porter* MD, Joshua P. Hazelton DO, Cooper University Hospital

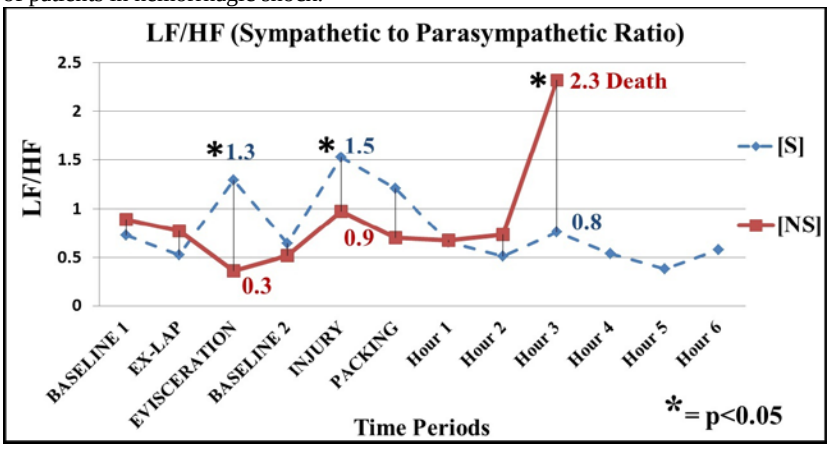
Introduction: Spectral analysis of continuous blood pressure and heart rate provides a quantitative assessment of autonomic response to hemorrhage. This may reveal markers of mortality as well as endpoints of resuscitation.

Methods: 14 pigs sustained a standardized retrohepatic IVC injury, progressed to class III hemorrhagic shock, then received abdominal packing followed by 6 hours of crystalloid resuscitation. Fourier transformation calculations were used to convert the components of BP waveform variability into its corresponding frequency classification. The relative sympathetic to parasympathetic tone was expressed as LF/HF ratio.

Spectral Frequency Classifications		
Very Low Frequency	VLF	Renin-Angiotensin Aldosterone
Low Frequency	LF	Sympathetic Tone
High Frequency	HF	Parasympathetic Tone

Results: Baseline hemodynamic parameters were equal for the Survival [S](n=11) vs Non-Survival [NS](n=3) groups. LF/HF ratio decreased during initial laparotomy and bowel manipulation in the non-survival group ([S]1.3 vs [NS]0.3 $p<0.05$). LF/HF ratio increased significantly before death compared to the corresponding time in the survival group ([S]2.3 vs [NS]0.8 $p<0.05$). The non-survival group had significantly lower VLF signal during the hemorrhage and resuscitation period ([S]29.8±2.5 vs [NS]5.6±3.9 $p<0.05$).

Conclusion: A decreased LF/HF ratio, indicative of parasympathetic predominance, prior to resuscitation is an independent risk factor for hemodynamic instability. However, an increased LF/HF ratio, indicative of sympathetic predominance, during resuscitation is a marker of impending death. Furthermore, a decreased VLF signal during resuscitation indicates an additional marker of impending death. These data indicate that quantitative assessment of autonomic response can be a predictor of mortality and guide resuscitation of patients in hemorrhagic shock.



Poster # 109

TRAUMATIC INJURIES CAUSE AN INCREASE OF THROMBOCYTIC AND ENDOTHELIAL MICROPARTICLES – ANALYSIS OF POSSIBLE BIOMARKER CORRELATED TO TRAUMA SEVERITY

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Introduction:
Microparticles (MP) are subcellular vesicles with a size of 0.1 - 0.9 µm, which are released after stimulation or apoptosis from different cell types such as thrombocytes and endothelial cells. Recent evidence suggests that MPs have a pivotal role at the conjunction of the cellular and plasmatic coagulation systems. The trauma-related failure of the coagulation system, the acute traumatic coagulopathy (ATC), and uncontrolled hemorrhage still account for approximately 50% of deaths within the first 48 hours after trauma. To understand the role of MPs after trauma, we analyzed the MPs' quantity and cellular origin compared to healthy individuals.

Methods:
Severely injured patients meeting the following criteria were included: Injury Severity Score ≥16, age ≥18 years, <2000ml preclinical iv-fluids and <120 minutes between injury and hospital admission. Healthy individuals (n=10) were used as control. Persons treated with coagulation-influencing medications were excluded in both groups. In trauma patients, blood was drawn at hospital admission and after 24 and 72 hours. Flow cytometry (BD Accuri C6) using cell specific markers were used to determine the MPs' quantity and their cellular origin of. Assessing the MPs' influence on the coagulation system, MPs were correlated with clinical data and thromboelastometry.

Results:
In 2015, 23 trauma patients were recruited with amean age of 59.6 ± 16 years and a mean ISS of 30.5 ± 13.5. Compared to healthy individuals, the number of thrombocytic CD42b+ MP were 8.7-fold higher (mean±SD: trauma 2481 ± 3338/µl vs healthy 285 ± 59/µl; $p<0.001$). Activated procoagulatoric MP were 21-fold higher (trauma 504 ± 883/µl vs. healthy 24 ± 30/µl; $p<0.001$). Endothelial CD144 + MP increased similarly (trauma 1246 ± 1138/µl vs. healthy 159 ± 95/µl; $p=0.001$). The number of thrombocytic MP correlated with white cell count ($p=0.02$) while the number of activated endothelial MP correlated negatively with coagulation parameters such as INR ($p=0.018$) and EXTEM-MCF ($p=0.04$).

Conclusion:
In conclusion, the number of circulating thrombocytic and endothelial MPs increased after trauma and was associated with injury severity. Assuming a procoagulatoric potential, these particles might counteract the development of ATC. Further studies will be required to determine the functional characterization of procagulatoric MP.

Poster # 110

Therapeutic trigger value of fibrinogen in patients with severe trauma

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Introduction: Low fibrinogen (Fb) level in patients with traumatic hemorrhage is key component of coagulopathy and associated with worse outcomes. Recent massive transfusion protocol has contributed to maintain the higher levels of fibrinogen, but the evidence for its trigger value is still weak. In this study, we aimed to clarify therapeutic trigger value of Fb in patients with severe trauma.

Methods: A single-institution prospective observational study was conducted from January 2012 to August 2015. Of 2,612 trauma patients admitted to a Japanese civilian trauma center, 1085 adult patients who were ISS >9 and transported from the scene as subjects in this study. Fb values were measured at the time of admission in all patients. Correlation was assessed with the Pearson method. Receiver operating characteristic (ROC) curve analysis was performed to evaluate the admission Fb level with respect to discriminating emergency transfusion (ET: transfusion with in 24 hours after admission) and mortality. Multivariable logistic regression was used to evaluate admission Fb level as an independent predictor of mortality. P values <0.01 were considered significant.

Results: Victims of blunt trauma accounted for 96.1%. Pre-hospital treatment was performed for 65.8% of the patients. Median age of the patients was 59 [IQR:42-70] years, median injury severity score (ISS) was 20 [13-33], and mortality rate was 12.6%. The proportions of patients with admission Fb levels below 1.0, 1.01 to 1.50, 1.51 to 2.0, more than 2.01 (g/L) were 9.1%, 16.6%, 27.7%, and 46.5%, respectively. Admission Fb value was associated with the injury severity (ISS; Correlation coefficient:-0.36, P<0.01, revised trauma score;0.45,P<0.01, respectively). The area under the curve of the ROC curve of Fb value for ET and mortality were 0.73 (95% confidence interval[CI]:0.70-0.76, P<0.01) and 0.88 (0.84 – 0.92, P <0.01). Multivariable analysis adjusted for age, ISS, RTS and pre-hospital treatment revealed that low Fb level below 1.50 g/L was predictor of mortality (Odds ratio:6.54, 95%CI:2.93-14.59, P<0.01).

Conclusion: Hypofibrinogenemia below the 1.50 g/L was a prognostic factor. This number would be acceptable to the therapeutic trigger value.

Poster # 111

CHANGES IN INSURANCE COVERAGE AND OUTCOMES AMONG YOUNG ADULT TRAUMA PATIENTS AFTER IMPLEMENTATION OF THE ACA

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Introduction: As the leading cause of death and disability among young adults (19-34y), trauma represents a considerable concern, particularly for uninsured paitents. The Patient Protection and Affordable Care Act (ACA) was designed to address this issue by increasing coverage in order to promote enhanced access to care. The full extent of its effects on clinical outcomes and insurance coverage remain unclear. We investigated the impact of the ACA, including the 2010 Dependent Coverage Provision (parents' plans until 26y) and 2013 Marketplace Open Enrollment and Medicaid Expansion.
Methods: Data from the 2009-2015 Maryland Health Services Cost Review Commission, which contains complete hospitalization records from all payers within the state, were queried for young adult trauma patients. Differences in insurance and outcomes were compared before/after DCP implementation (2009 vs. 2011) and enrollment/expansion (2011-2012 vs. 2014-2015) using difference-in-difference (DID) models to compare initially-eligible (<26y) vs. ineligible (≥26y) patients. Stepwise before/after changes were further considered among young adults as a whole and based on variations in stratified demographic sub-groups. Joinpoint (time-trend) regressions assessed overall changes in trends from 2009-2015.
Results: A total of 32,322 trauma admissions were included. DCP rollout corresponded to a significant 4.7% absolute increase in private insurance among eligible patients, despite declining rates of privately-insured among patients aged ≥26y (-4.1%; DID 8.8% p<0.001). Corresponding drops in uninsured (DID -3.5% p=0.034) were driven by changes in White (-6.2%), male (-4.9%) patients and did not alter trauma outcomes. Rollout of the full ACA, in contrast, demonstrated significantly greater gains (DID p<0.001) among older patients that were significant for both initially-eligible and ineligible patients: overall Medicaid +21.1%, uninsured -18.7%, private -3.3%. Differences were most pronounced among underserved populations and coincided with a +5.2% gain in discharge to rehabilitation, +1.42 day increase in LOS, and -0.44 day required ICU stay (p<0.001). In-hospital morbidity and mortality did not change.
Conclusion: In contrast to marginal gains associated with implementation of the DCP, which tended to affect privileged patients and did not alter trauma outcomes, introduction of Medicaid Expansion in 2013 (FY 2014) was associated with an 18.7% drop in uninsured and significant changes in clinical outcomes. Among young adult patients, these changes were driven by a 21.1% increase in Medicaid coverage that coincided with a significant decline in the proportion of patients who were privately insured.

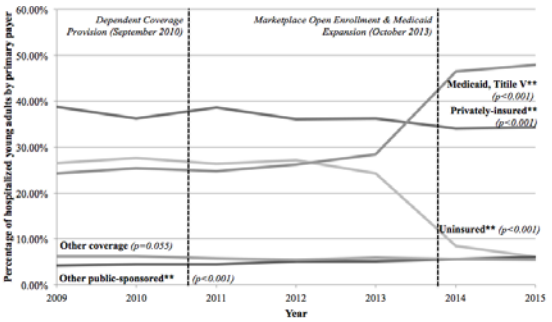

Figure: Changes in insurance coverage, 2009-2015, and joinpoint regression results

Poster # 112

MANAGEMENT OF RIB FRACTURES: NATIONAL TRAUMA DATABASE EVAULATION OF RIB FIXATION

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Introduction: Rib fractures are commonly associated with blunt chest wall trauma and are seen in up to 40% of this patient population. The cornerstone of management of chest wall trauma includes multi-modal pain control for adequate respiratory mechanics. Current recommendation is for consideration of rib fixation in patient with flail chest as studies have shown improved outcomes for this diagnosis. However, there have been increased indications for surgical fixation in the recent years with no large study confirming improved outcomes. This NTDB study will evaluate indications, timing, and outcomes of patients undergoing rib fixation during a two year period.

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 patients who received rib fixation were compared to patients managed without fixation. Propensity score matching was then performed and outcomes compared between the two groups.

Results: During the two year study period, 183,456 patients with rib fractures were identified. The rib fixation group included 12,528 patients and 170,928 patients had no rib fixation. Overall, patients who underwent rib fixation were younger (47 versus 53 years old, $p< .0001$), more severely injured (average ISS 22 versus 14, $p< .0001$), and had a higher mean chest AIS score compared to the no fixation group. Patients within the rib fixation group were also more likely to have pulmonary contusions, hemothorax, pneumothorax, flail chest, require tube thoracostomy, and had higher number of rib fractures. Flail chest was seen in 11% of the rib fixation group compared to 4% of the no fixation group, $p< .0001$. Only 1% of patients within each group received epidural or para-vertebral analgesia. Overall outcomes found that patients undergoing rib fixation had increased length of stay (12 versus 5 days, $p< .0001$), ventilator days (7 versus 4 days, $p<.0001$), pneumonia (12.2% versus 5%, $p< .0001$), but a decrease in mortality (2.2% versus 5.2%, $p< .0001$). Average time to rib fixation was 1 day. On propensity score matching similar outcomes were found.

Conclusions: Over a two year period, 7% of patients with rib fractures underwent rib fixation. Several meta-analyses have found improved outcomes in patients undergoing rib fixation for flail chest. However, our data confirms that indications for rib fixation is much broader as only 11% of patients undergoing fixation had flail chest. The current study found that patients undergoing fixation were more severely injured, but still had a significant survival benefit.

Poster # 113

ACCESS TO HEALTH INSURANCE IS NOT SUFFICIENT TO IMPROVE NON-ECONOMIC OUTCOMES AFTER INJURY

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Introduction: Retrospective studies indicate that lack of health insurance is associated with increased morbidity and mortality after injury, particularly for patients in the lowest socioeconomic levels. Further, injured patients in the lowest socioeconomic strata are thought to have higher healthcare utilization and higher out of pocket costs than those in higher socioeconomic strata. Access to health insurance for injured patients in the lowest socioeconomic strata may improve these outcomes. In 2008, a limited expansion of the Medicaid program in Oregon occurred for low–income adults. The expansion was accomplished by random lottery, creating a randomized controlled trial of insurance coverage among those in the lowest socioeconomic levels. The purpose of this study was to determine the effect of insurance coverage on mortality, quality of life, healthcare utilization and out of pocket costs among injured patients.

Methods: The Oregon Health Insurance Experiment Public Use Files were utilized for this study. Adults (≥18) who were eligible for Medicaid and who suffered an injury after randomization were included in this post-hoc analysis of the randomized trial. Those selected for Medicaid were compared to those without coverage. Outcomes of interest were mortality, quality of life (Short-Form 8), healthcare utilization, and personal healthcare expenditures.

Results: 2,527 patients met inclusion criteria, and 986 were randomized to Medicaid. There were no differences in age, gender or race between those Selected and Not Selected for Medicaid. For those injured any after randomization, there were no differences in emergency department visits, hospitalizations, quality of life, or mortality at 1 year. However, those without Medicaid were more likely to have out of pocket health care expenditures and to have to borrow money to pay for health care related debts than those selected for Medicaid (Table, *p<0.05 vs Selected).

	Selected n = 986	Not Selected n = 1541
ED Visits (mean±se)	3.2±0.1	3.3±0.08
Hospitlizations (mean±se)	0.38±0.4	0.35±0.04
Quality of Life – SF-8		
Physical Component Score (mean±se)	42.8±0.5	42.3±0.5
Mental Component Score (mean±se)	41.8±0.6	42.1±0.5
1 year mortality	1.4%	1.6%
Any out of pocket expenditures	55%	63%*
Had to borrow money to pay for healthcare	23%	30%*

Conclusion: In this randomized natural experiment, obtaining health insurance did not result in reductions in mortality, improvements in quality of life nor reduced healthcare utilization for injured patients. However, having insurance protected injured patients in the lowest socioeconomic strata from financial consequences of their injury. Simply improving insurance access does not appear to change injury related morbidity and mortality in a state with a developed, inclusive trauma system. Except for personal economic outcomes, access to high quality trauma care in an inclusive, developed trauma system may equalize outcomes for those in low socioeconomic strata more than just access to insurance coverage. Policies that encourage equal access to trauma care may result in similar health related outcomes after injury. On the other hand polices that provide health insurance for injured in the lowest socioeconomic strata may limit the personal financial consequences for these vulnerable, injured patients.

Poster # 114

Heath-related quality of life in trauma patients at 12 months after injury: a prospective cohort study

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Introduction: There are few prospective studies of the health-related quality of life (HRQOL) post trauma. The aim of our study was to assess the HRQOL improvement of trauma patients at 12 months after injury using the Short Form (SF-36) Health Survey, which is a patient-reported survey of the patient's health status.

Methods: A prospective cohort study was performed in our tertiary care hospital from September 2013 to January 2015. All consecutive trauma patients who were admitted to our department were included except for those under the age of 18, or with coexisting cognitive impairment, or deceased. SF-36 scores were obtained by direct interviews based on a standardized protocol at discharge and by mail at 6 and 12 months after injury. The primary outcome is 8 domain scores in SF-36. We followed their changes for 1 year. SF-36 scores were adjusted for age and gender.

Results: During the study period, complete data collection was achieved in 84 out of 119 patients. The median age was 68 years (interquartile range: 51 to 75), and 54 (60%) were male. Median ISS was 17.5 (IQR: 13 to 24), length of stay at our department was 21 days (IQR: 5 to 41) and total length of hospital stay was 51 days (IQR: 18 to 110). Although six of the eight SF-36 domains (Physical Functioning, Role Physical, Bodily Pain, Social Functioning, Role Emotional and Mental Health) improved significantly between discharge and 6 months after injury, there was no significant increase ($p<0.05$) in any SF-36 domains between 6 months and 12 months after Injury. All domain scores at 12 months after injury were lower than 50.

Conclusion: Domains at 12 months after injury were lower than national norms. The domain scores only improved within 6 months post trauma, when more than 80% of the patients had already returned home. Our results suggest that trauma patients need more HRQOL support in both social and mental status even after discharge.

	At discharge Median(IQR)	6 months after injury Median(IQR)	12 months after injury Median(IQR)
Physical Functioning	20(8,38)	42(32,52)*	44(35,56)
Role-Physical	19(4,31)	38(23,48)*	40(26,53)
Bodily Pain	35(29,43)	41(35,51)*	45(37,54)
General Health	46(39,53)	46(41,52)	47(40,57)
Vitality	42(31,49)	43(34,52)	44(39,52)
Social Functioning	33(18,45)	41(30,56)*	45(33,57)
Role-Emotional	33(18,52)	40(28,54)*	44(33,55)
Mental Health	39(31,49)	44(38,54)*	47(26,44)

*$p<0.05$ There was significant increase between at discharge and 6months after injury. There was no significant increase in all SF-36 domains between at 6 months and at 12 months after Injury.

Poster # 115

BIGGER IS BETTER: 10-GAUGE ANGIOCATHETER DECOMPRESSION OF TENSION HEMOPNEUMOTHORAX (t-H/PTX) AND RESCUE FROM TENSION-INDUCED PULSELESS ELECTRICAL ACTIVITY (PEA) ARREST IN A POSITIVE-PRESSURE VENTILATION YORKSHIRE SWINE MODEL

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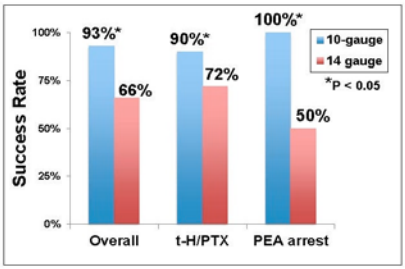
Introduction: Tension pneumothorax (tPTX) is a cause of potentially preventable death in pre-hospital and battlefield settings; however, traumatic PTX is frequently associated with a hemothorax (HTX). 14-gauge (14g) angiocatheter (AC) decompression is the current treatment standard, but has a high incidence of failure and no proven efficacy for associated HTX.

Methods: A t-H/PTX model was created through modification of our swine tPTX model. 10% estimated blood volume was instilled into each chest. Tension physiology was achieved with escalating CO2 insufflation and air leak simulated with intermittent flow. Needle decompressions with either 10-gauge (10g) or 14g AC were performed. After recovery, serial PEA events were induced and likewise decompressed. Success of rescue, time to rescue, and physiologic data were recorded. Necropsy was performed to assess catheter positioning and any iatrogenic thoracic injuries due to AC placement.



Results: 99 t-H/PTX and 43PEA events were conducted in 13 Yorkshire swine. 10gAC was dramatically more successful at rescue from both t-H/PTX or PEA,compared to 14g AC (Figure). The overall success rate was 93% for 10g vs only 66% for 14g ($p<0.01$). The median time to rescue for decompression of t-H/PTX was over twiceas long with 14g AC versus the 10g device (52 vs 22 secs, $p<0.01$). The incidence of successful rescue did not differ between anatomic location (mid-clavicular or axillary) for either device. Necropsy demonstrated no significant iatrogenic injuries. Failures appeared largely related to occlusion by blood or tissue, although a few catheters were kinked or malpositioned.

Conclusion: A 10g AC is superior to 14g AC for successful decompression of t-H/PTX and rescue from tension-induced PEA arrest in a positive pressure ventilation swine model. It also resulted in significantly faster rescue times versus the 14g AC, and was not associated with any identified major iatrogenic injuries. Further human studies are warranted to validate these findings and potentially field the 10g AC for military and civilian use.

Poster # 116

CLAMPING TRIALS PRIOR TO THORACOSTOMY TUBE REMOVAL AND THE NEED FOR SUBSEQUENT INVASIVE PLEURAL DRAINAGE

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Introduction: Clamping trials—a period of clamping thoracostomy tubes for a few hours prior to possible tube removal—may help reduce the likelihood of pneumothorax after tube removal, but there is little evidence for or against this practice. Prior to 2013, our trauma surgery services routinely performed clamping trials, but this practice ceased in 2013. We sought to evaluate whether thoracostomy tube clamping trials might reduce the need for subsequent pleural drainage procedures.

Methods: We conducted a single-institution, retrospective cohort study of all patients who underwent tube thoracostomy for traumatic injury from 7/2009-7/2012 and 7/2013-3/2015. We excluded subjects on positive pressure ventilation and those who had tubes placed during thoracic operations. We compared subjects who underwent a clamping trial to those who did not ("control"), using the time of clamping or tube removal, respectively, as the index time point and adjusted for confounding factors. The primary outcome was a subsequent invasive procedure to drain the ipsilateral pleural space within 30 days. Secondary outcomes within 30 days included subsequent: pneumothorax, effusion, or hemothorax; length of stay; and numbers of chest radiographs and CT scans.

Results: Of 985 subjects who underwent tube thoracostomy during the study period, 193 clamping trial and 228 control subjects met eligibility criteria. Mean age (38 ± 18 vs. 41 ± 18 years), sex (77% vs. 75% male), and proportion with penetrating injury (32% vs. 28%) were similar in the clamping trial and control groups, respectively. Chest Abbreviated Injury Scale score was lower in the clamping trial group (3.3 ± 0.7 vs. 3.6 ± 0.8). Rates of subsequent pneumothorax, effusion, or hemothorax were similar between groups [57 (29%) vs. 64 (28%); adjusted OR 0.90 (95% CI 0.57-1.42)], but clamping trials resulted in lower likelihood of a pleural drainage procedure [14 (7%) vs. 27 (12%); adjusted OR 0.43 (95% CI 0.20-0.92)]. Subsequent length of stay and number of chest radiographs were similar between groups, while clamping trials were associated with lower likelihood of a chest CT scan [14 (7%) vs. 36 (16%); adjusted OR 0.47 (95% CI 0.24-0.92)].

Conclusion: A clamping trial prior to thoracostomy tube removal reduced the need for subsequent pleural drainage procedures and CT scans of the chest.

Poster # 117

The Aging Methamphetamine Positive Trauma Patient: Increasingly Common, Increasingly Costly

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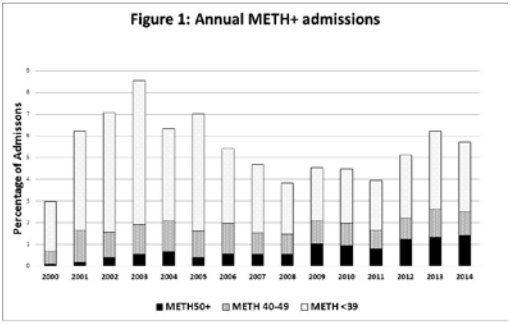
Introduction: Methamphetamine use creates a burden on our society and trauma systems. As the US population ages, we sought to determine the incidence of complications and utilization of resources by methamphetamine positive trauma patients age 50 to 75 years.

Methods: The trauma registry of a Level 1 Trauma Center with 33,036 admissions from 2000 to 2014 was used to compare demographics and mechanism of injury for patients 50-75 years with toxicology positive for methamphetamines and metabolites (METH50+). We compared the METH50+ group with a 3:1 cohort of toxicology-negative trauma patients matched by age, gender, mechanism of injury, and AIS/ISS. Length of stay (LOS), pre-existing conditions, recidivism, total hospital charges, discharge disposition, complications and payor information were analyzed.

Results: There were 247 METH50+ trauma patients, increasing from 0.32% of admissions age 50 years and older in 2000 to 2.9% in 2014 (Figure 1). METH50+ patients suffered more interpersonal violence and self-inflicted injury than non-users (23.1% vs 9.0%; p<0.001). In comparison to matched controls, METH50+ had longer median LOS (2.26 vs 1.97 days; IQR: 4.45 vs. 3.69, p=0.026) and higher hospital median charges ($37,806 vs. $31,456; IQR: $54791 vs $36686, p<0.001) and payors were more likely to be self-pay, Medicaid, Medicare or county welfare than to be private insurers (76.6% vs. 65.8%; p<0.001. METH50+ patients were more likely to have preexisting renal (4.0% vs. 1.5%; p=0.02) and liver conditions (8.4% vs. 4.7%; p=0.031). Complications more likely to occur in the METH50+ patients included vascular complications (5.2% vs. 2.5%, p=0.038), thrombus or embolus (4.9% vs. 2.3%; p=0.039), errors in technique (2.8% vs 0.4%; p=0.001) and provider-related errors and delays (22.2% vs. 15.8%, p=0.026). Same-center trauma recidivism was similar in METH50+ and matched controls (0.7% vs. 0.4%, N.S.).

Conclusions: Urine toxicology of trauma patients 50-74 years reveals increasing methamphetamine use. METH50+ screening identifies a patient group with higher charges, less insurance coverage and more complications that impact healthcare quality indicators. Opportunities exist for provider education and preventive interventions.



Poster # 118

Ballistic thoracic trauma over forty years in an urban trauma center

Keith R. Miller MD, Glen A. Franklin* MD, Matthew V. Benns* MD, Matt C. Bozeman MD, Brian G. Harbrecht* MD, Nicholas A. Nash MD, Jason W. Smith* MD, J. David Richardson* MD, University of Louisville

Introduction:
Although the practice of surgery continues to trend towards less invasive techniques, traditional operative techniques including thoracotomy and laparotomy have remained the mainstays of emergent trauma management. Historically,however, operative intervention has been required in the minority (15%) of patients sustaining ballistic chest trauma as most are managed with chest tube insertion alone. Over the last forty years, significant increases have been observed throughout the United States in the manufacture, sale, and utilization of higher caliber weaponry. Changes in injury patterns in the setting of ballistic chest trauma over this same time period have not been described. We hypothesized that the increasing caliber of weaponry over the study interval would result in increased invasiveness in the management of ballistic chest trauma.

Methods:
Retrospective chart analysis of thoracic gunshot wounds from the gunshot registry of an urban level I trauma center was performed over four decades.

Results:
The overall number of patients treated for ballistic chest trauma did not change. However, need for major operative intervention (laparotomy or thoracotomy) has increased to include nearly half (47%) of patients. The majority of this pattern is a result of increased requirement for pulmonary resection, concurrent laparotomy for abdominal injuries and delayed intervention for retained hemothorax. Cardiac injuries have become infrequent. Mortality is unchanged.

	1973-1975	**1987-1989**	**2006-2008**	**2013-2015**
Total Cases (avg/yr)	136 (45.3)	103 (34.3)	111 (37)	122 (40.6)
Thoracotomy	17 (12.5%)	11 (10.7%)	22 (19.8%)	19 (15.6%)
Delayed VATS	0 (0 %)	5 (4.9%)	18 (16.2%)	8 (6.6%)
Cardiac Injury	17 (12.6%)	19 (18.4%)	4 (0.4%)	3 (2.5%)
Pulmonary Resection	0 (0%)	1 (0.01 %)	17 (15.3 %)	7 (5.7%)
Operative Intervention	26 (19%)	30 (29%)	44 (40%)	57 (47%)
Overall Mortality	27 (20%)	16 (15.5%)	18 (16.2%)	23 (18.8%)

Conclusion:
Manufacture, distribution, and characteristics of firearms involved in crime have shifted towards larger caliber weaponry over the last forty years. Operative intervention in the post-injury period has increased dramatically and is attributed primarily to three variables: pulmonary resection, concurrent laparotomy, and need for delayed VATS in the setting of retained hemothorax. Cardiac injuries have essentially disappeared, presumably related to non-survival in the setting of higher caliber weaponry.

Poster # 119

THE USE OF SINGLE DOSE CEFAZOLIN FOR TUBE THORACOSTOMY PLACEMENT REDUCES CULTURE PROVEN PNEUMONIA

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Introduction:
The 2001 EAST Practice Management Guidelines stated insufficient evidence to suggest prophylactic or presumptive antibiotics for tube thoracostomy (TT) and the most recent consensus in 2012 mirrors that there is still insufficient evidence to make a recommendation. We reviewed our 7 year experience after changing our protocol from no antibiotics to a single dose of cefazolin for TT placement.

Methods:
A comparative effectiveness study was performed utilizing our National Trauma Databank. Trauma patients who had TT between February 2007 and December 2014 were collected. We excluded patients who died within 3 days of TT insertion. Primary endpoints were empyema with positive pleural cultures and pneumonia confirmed by bronchoalveolar lavage (BAL) cultures. Patients who were allergic to cefazolin or who had received antibiotics for other injuries within three hours of TT placement were analyzed in the antibiotic group. SPSS software was employed for analysis.

Results:
There were 401 patients, of whom 49 had TT placed before transfer and were excluded, leaving 352 patients; 183 received antibiotics within 3 hours of TT (CTAB) and 169 did not (CTN). Demographics were similar in ISS (22.8 and 23.4), age (50.4 and 47.4), and mechanism (79.8 and 79.5% blunt). The rate of empyema was 2.8% (n=5) in CTAB and 4.7% (n=8) in CTN. There was no difference in outcomes with ED, ICU or floor TT placement. There was a statistically significant reduction of pneumonia from 13.5% (n=23) in CTN to 6.1% (n=11) in CTAB (odds ratio =0 .4895% CI .001 – 77.1%). There was actually a reduction in resistant organisms in CTAB cultures but this was not significant [16 (8.8%) in CTAB compared to 18 (10.6%) in CTN].

Conclusion:
Consistent with prior studies we found a reduction in pneumonia. For empyema, we would need 20 years of data to achieve statistical significance. This study adds to the current role of antibiotics in TT by using cultures for diagnosis and only a single dose of antibiotics. Because the benefit of TT antibiotics was unchanged and there was reduced bacterial resistance, the single dose protocol is equal to and likely better than 24 hours.

Poster # 120

COMBAT MORTALITY INDEX (CMI): AN EARLY PREDICTOR OF MORTALITY IN COMBAT CASUALTIES

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Introduction: Early detection of hemorrhagic shock has a discernable impact on timely interventions and can mitigate mortality risk. The current Shock Index (SI)lacks reliable predictive capacity and the anatomic-based scoring systems have limited applicability in the forward-deployed setting. We propose a Combat Mortality Index (CMI) that is rapid, easy to determine, has prehospital and hospital-based components. The CMI reliably predicts early mortality, and enables early identification of combat casualties at risk for mortality in the battlefield environment.

Methods: Data were obtained from the JTS Role II Registry. Inclusion criteria were age ≥18, injured in Afghanistan from 1/2008 to 9/2014, treated at a Role II facility (R2), and complete data of the variables tested. We constructed a new SI profile using vitals (SBP, HR, GCS) and routine labs (BD and INR) (Table 1). The CMI was constructed in two models for pre- and in-hospital (PH and IH) assessment and defined as a sum of defined parameters. The CMI-PH & IH were compared to the existing revised trauma score (RTS), field triage score (FTS), and SI. Area under the ROC curve (AUROC) and Hosmer-Lemeshow test were used to discriminate and calibrate the CMI(s) from the existing indices. Logistic regression was used to calculate the likelihood of mortality.

Table 1. Markers to be validated as a predictor of combat-related mortality in patients who arrived at Role II Afghanistan

Marker	Definition	AUROC (95% CI)
RTS	0.9368*GCS-Total+ 0.7326*SBP+ 0.2908*RR	0.79 (0.71-0.86)
FTS	SBP≤100 and GCS-Motor <6	0.87 (0.79-0.94)
SI	HR/SBP: >0.9 or <0.5	0.74 (0.65-0.84)
CMI-PH	HR={0,1} + SBP={0,1} + GCS-total={0,1,2} *HR scaled 0 to 1 as 60-100 and <60 or >100 bpm, SBP scaled 0 to 1 as ≥100 and <100 mmHg. GCS-total scaled 0-2 as ≥14, 9-13, and 3-8.*	0.90 (0.85-0.96)
CMI-IH	HR={0,1} + SBP={0,1} + GCS-total={0,1,2} + BD={0,1,2} + INR={0,1,2} *HR, SBP, and GCS-total defined as CMI-PH. BD scaled 0 to 2 as >-2.0, -2.0--5.0, and <-5.0. INR, scaled 0-2 as <1.5, 1.5-2.0, >2.0.*	0.96 (0.94-0.98)

Abbreviations: RTS, revised trauma scale; FTS, Field triage score; SI, shock index; CMI, Combat Mortality Index; CMI-PH, CMI- for pre-hospital assessment; CMI-IH, CMI- for in-hospital assessment; GCS, Glasgow coma scale; SBP, systolic blood pressure; RR, respiratory rate; HR, heart rate; bpm, beat per minute; BD, base deficit scaled; INR, International Normalized Ratio; AUROC, Area under the Receiver Operating Characteristic Curve.

Table 2. Mortality rate (%) at Role II Afghanistan by CMI models (-PH and -IH)

Score	CMI-PH (%)	CMI-IH (%)
0	0.1	0
1	1.3	0.1
2	7.1	1.5
3	19.7	1.9
4	–	6.3
5		11
6		23.8
7		27.3
8		–

Abbreviations: CMI, Combat Mortality Index; CMI-PH, CMI-pre-hospital (5 scores ranged 0-4); CMI-IH, CMI in-hospital (9 scores ranged 0-8).

Results: 4240 patients met inclusion criteria. Overall mortality was 1.30% (n=55). For CMI-PH model (5 scores ranged 0 to 4), 9.2% patients presented at R2 with CMI-PH score of 2 & 3, accounting for 7.1% and 19.7% mortality. For CMI-IH model (9 scores ranged 0 to 8), 7.9% patients had CMI score 4 to 7, accounting for an incremental mortality rate from 6.3% to 27.3%, respectively (Table 2). AUROC showed the CMI(s) are better predictors of mortality (Table 1) and better fit than other tested indices. Increase in the CMI score was also associated with increase in mortality.

Conclusion: The CMI is a rapid, accurate, reproducible, and 'user friendly' scoring system that may help predict combat casualties at risk for early mortality. This score has potential battlefield implications from triage, to the use of pre-hospital blood and hemostatic agents, to expeditious evacuation. Additional analysis should be performed in the pre-hospital setting, and for combat casualties presenting to a Role III combat support hospital, as well as in civilian trauma patients.

Poster # 121

REDUCTION OF FATALITIES AND INJURIES RELATED TO MOTOR VEHICLE COLLISIONS FOLLOWING SPEED LIMIT REDUCTION IN NEW YORK CITY: A PRELIMINARY REVIEW ONE YEAR LATER

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Introduction: Despite major reductions in associated injuries and deaths, there are 2.9 million injuries and 40,000 deaths annually related to motor vehicle collisions (MVCs) in the US. In Sweden, traffic fatalities have decreased 30% since 1997 following a speed limit reduction initiative. Largely based on the Swedish initiative, in 2014 New York City (NYC) adopted Vision Zero (VZ), an action plan to end traffic fatalities and injuries primarily by decreasing the speed limit from 30 to 25 mph. We hypothesize VZ would result in significantly less injuries and deaths related to traffic MVCs.

Methods: Using public NYC OpenData data sets, we reviewed all MVCs in NYC provided by the Police Department from 12 months before and 12 months after the initiation of the speed limit change on November 6, 2014. US Census population estimates for NYC for the study period were used to calculate incidence of injured and killed persons, injured and killed pedestrians, and injured and killed motorists. We then compared this data between the two 12-month periods.

Results: There was an overall significantly decreased rate of incidence of fatalities and injuries. See Table 1 below.

	Year Before VZ (n=206,832)	Year After VZ (n=214,874)	*p* value
Accidents Involving Injured Persons	37883 (18.32%)	37327 (17.37%)	<0.01*
Incidence Rate of Injured Persons (per 100,000)	615.98	597.16	<0.01**
Accidents Involving Killed Persons	274 (0.132%)	226 (0.105%)	0.010*
Incidence Rate of Killed Persons (per 100,000)	3.43	2.74	0.012**
Incidence Rate of Motorists Injured (per 100,000)	317.62	428.96	<0.01**
Incidence Rate of Motorists Killed (per 100,000)	1.37	1.08	0.095**
Incidence Rate of Pedestrians Injured (per 100,000)	132.05	119.47	<0.01**
Incidence Rate of Pedestrians Killed (per 100,000)	1.82	1.46	0.067**

*=Pearson's Chi Square **=Two Population Proportion Test

Conclusions: Based on census estimates, a decrease in the NYC citywide speed limit from 30 to 25 mph for one year was associated with a significantly decreased rate of incidence in overall fatalities and injuries, pedestrian injuries, and a strong trend toward decreased pedestrian fatalities. This preliminary report suggests VZ may be successful; however, further study over an extended time period is warranted to verify these findings.

Poster # 122

PATIENT COMPREHENSION AND COMPLIANCE WITH POST-SPLENECTOMY INFECTIOUS RISK REDUCTION

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Introduction: Patients undergoing splenectomy are at life-long risk for developing episodes of rapidly progressive septicemia known as Overwhelming Post-Splenectomy Sepsis (OPSS). In an effort to reduce risk, splenectomy patients are recommended to receive vaccinations against pneumococci, meningococci, *Haemophilus influenza* type b, and influenza virus. Patients should also be placed on an appropriate re-vaccination schedule and receive education regarding the importance of fever or infectious symptoms given their asplenia. However, as most patients do not follow up with their trauma providers beyond their initial period of injury convalescence, little is known about compliance in regards to post-splenectomy risk reduction over time. The purpose of this study was to investigate long term patient understanding and follow-up with recommendations regarding their asplenia.

Methods: All patients undergoing splenectomy for trauma over a 5 year period (1/1/2010-12/31/2014) were analyzed. Medical records were reviewed and telephone follow-up interviews were conducted from 10/2015-12/2015. Patients were excluded from further analysis if they could not be reached for interview after three attempts. Patients were asked a standard set of questions that included hospitalizations since their original admission, awareness of the infectious risks associated with asplenia and the need for re-vaccination, how they were informed of the risks of asplenia, and what type of vaccines they had received since their index hospitalization.

Results: 236 patients underwent splenectomy during the study period. All patients received initial vaccinations prior to discharge. All patients had a documented discussion from a trauma practitioner, as well as written information provided at discharge regarding their condition and the vaccinations they had received. A total of 90 patients (38%) were successfully contacted and included in the study. 27 patients (30%) had been hospitalized since their trauma admission. 11 of those patients (40.7%) were admitted for various infections, including 5 patients with pneumonia and 1 patient with meningitis (concomitant brain injury with history of instrumentation). None of these patients described having OPSS. Only 44.4% of patients were aware of the risks of asplenia and the need to re-vaccinate. Among those aware, only 14.9% recalled being educated prior to discharge, with the majority (51%) stating they learned from their primary care provider. The majority of patients (64.3%) greater than 5 years out from their splenectomy had not been appropriately revaccinated for pneumococci. Nearly half (46.6%) of patients had not received an influenza vaccine.

Conclusion: Despite uniform education prior to discharge, most patients undergoing splenectomy for trauma at our institution were unaware of the risks of OPSS and did not follow recommended guidelines for risk reduction. Though OPSS is rare, it carries a significant mortality. Further studies targeting methods to improve compliance with recommendations are indicated.

Poster # 123

DEFINING EXPERT DECISION-MAKING FOR THE MANAGEMENT OF TRAUMA PATIENTS

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Introduction: The management and outcome of trauma patients are heavily dependent onsound judgment and effective decision-making. Yet, current methods for training and assessing these advanced cognitive skills are subjective, lack standardization and are prone to error. This qualitative study aims to define and characterize the high-level cognitive competencies and other non-technical skills required to optimally manage injured patients.

Methods: Cognitive and hierarchical task analyses for managing unstable trauma patients were performed using qualitative methods to map the thoughts, behaviors and practices that characterize expert performance. Trauma team leaders and board-certified trauma surgeons participated in semi-structured interviews that were audio-recorded and subsequently transcribed verbatim. Verbal data were supplemented with content from published literature and prospectively-collected field notes from in-vivo observations of the trauma team during trauma activations. The data was coded and thematically analyzed using grounded-theory by two independent reviewers, and synthesized into a list of items and a conceptual framework.

Results: A framework was created based on 14 interviews with experts (lasting 1-2 hours each), 35 field observations (20 (57%) blunt; 15 (43%) penetrating; median Injury Severity Score 20 [13-25]), and 7 literary sources. Experts included 11 trauma surgeons and 3 emergency physicians from seven Level 1 academic institutions in the United States and Canada (median years in practice: 12 [8-17]). Twenty-nine competencies were identified, including 17 (59%) related to situation awareness, 6 (21%) involving decision-making, and 6 (21%) requiring other non-technical skills. These competencies were categorized into 13 themes: “physiologic burden” (N=6), “mechanism” (N=2), “injury and pattern recognition” (N=1), “active and confirmatory reconciliation” (N=2), “data processing and metacognition” (N=2), “environmental limitations” (N=2), “self limitations” (N=2), “leadership” (N=3), “teamwork and communication” (N=3), “forward planning” (N=2), “managing the injury” (N=2), “prioritizing” (N=1), and “escalation of aggressiveness” (N=1). Of 42 potential errors that were identified, root causes were mapped to errors in situation awareness (20 (48%)), decision-making (11 (26%)) or other non-technical interpersonal skills (11 (26%)).

Conclusion: This study defines cognitive and other non-technical aptitudes that are essential for the management of trauma patients. This framework may serve as the basis for novel curricula to train and assess advanced decision-making skills, and to develop quality-control metrics to improve team and individual performance and prevent errors.

Poster # 124

MORNING REPORT DECREASES LENGTH OF STAY IN TRAUMA PATIENTS BY CHANGING CARE PLANS IN 20% OF PATIENTS

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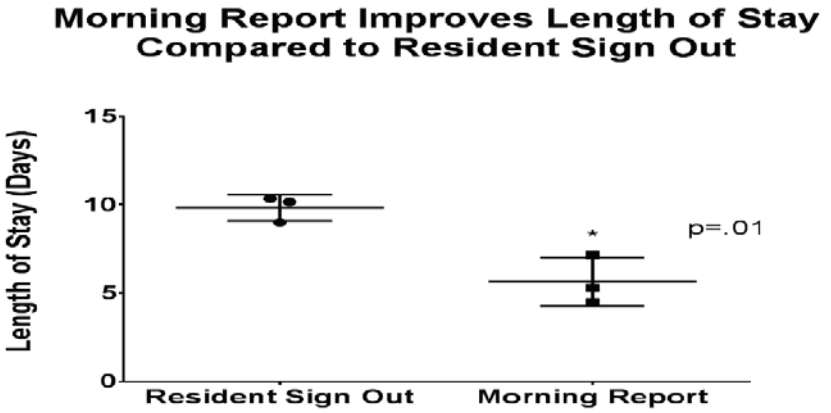
Introduction: Modern trauma surgery programs depend on consistent patient hand-offs to facilitate care as most programs have transitioned to shift based coverage. We sought to determine the impact of implementing a morning report process on length of stay and to prospectively collect changes to the plan of care.

Methods: Prior to the intervention hand-offs were communicated between resident teams without attending provider supervision and post intervention hand-offs were completed between resident teams with oversight from 3 attending surgeons (night call, trauma day call, and emergency general surgery day call). Changes to the plan of care were collected prospectively by an advanced practice nurse and retrospectively classified into the following categories: medication changes, addition of a procedure, avoidance of a procedure, protocol deviations, and other. Data collection for the study lasted 90 days.

Results: During the study period 71 surveys were completed (79% response rate) detailing 219 trauma admissions (152 Floor (69.4%) and 67 ICU (30.6%). Changes to the plan of care occurred in 44 patients (20%). The most common change (n=20, 45%) was the addition of a procedure, followed by medication changes (n=15, 34%). With medication changes, most were changes in pain management. Using Student's t-test, the mean length of stay for the study period was 5.6 + 1.3 days and was significantly decreased compared to the same 90 day period the previous year 9.8 + 0.7 days (p=.01).



Conclusion: Implementation of an attending supervised, trauma, morning report is associated with a decreased length of stay and changes to the plan of care in 20% of patients. The most common changes that occurred during this hand-off were the addition of procedures and changes in pain management. Further work needs to be done in this area to determine how changes to the plan of care impact length of stay.

Poster # 125

HOSPITAL-BASED VIOLENCE INTERVENTION PROGRAMS: A MULTI-INSTITUTIONAL ANALYSIS OF OUR TARGET POPULATION AND THEIR NEEDS FOR RISK REDUCTION

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Introduction: Homicide is the leading cause of death in African Americans (AA) aged 15-24 years and second in Latinos. Hospital-based violence intervention programs have been established to reduce future risk of violently injured individuals. To date, comprehensive information regarding the population and needs these programs address is lacking. The National Network of Hospital Based Violence Intervention Programs (NNHVIP) is an organization for programs that provide culturally competent case management and work to address risk factors associated with violent injury. The aim of this multi-institutional feasibility and utility study is to identify enrollment characteristics, patterns of bellwether needs, and differences amongst our cohort of clients in six of the founding NNHVIP programs.

Methods: Client data on demographics and needs were prospectively entered into a centralized database. Continuous variables were compared using ANOVA while nominal variables were compared using Fisher exact test. Ethics approval was obtained for all six programs. Chi squared analysis was used to test associations between observed and expected frequencies.

Results: Over a 5-year period, 4366 clients were included, 81.7% of which are male. The majority (64%) were African American (AA), followed by Latinos (22.4%), and Whites (8.2%). Gunshot Wound (GSW) was the most common mechanism (42.9%), followed by stab wounds (35.7%). GSW comprised 57.9% of injuries among AAs, but only 35.7% of Latinos, who were primarily victims of stabbings (55.6%). Women comprised 18.3% of clients, consistent among races (p=0.86). Women were more likely to be victims of blunt assault (p = 0.0005). 2839 of the clients were 18 to 35yo. When regional differences were assessed, the East Coast programs had a higher proportion of African Americans (67.5%) than West Coast programs (38.6%). There were no regional differences based on gender. Representation by race among bellwether client needs that programs work to address were statistically significant (see table).

Conclusion: Hospital-based violence intervention programs principled in the public health model continue to emerge. As these programs grow in size and number nationally, it is critical to understand characteristics of our clients and their needs which if addressed could mitigate future violent injury risk. This multi-institutional study identifies AA as having higher than expected need for employment and mental health whereas Latinos had higher than expected need for mental health, education and housing. In response to these findings, focused resource allocation, culturally appropriate case management, and advocacy efforts can be more effective in strengthening these programs and counseling fledgling programs in an ultimate effort to reduce violent injury in our most vulnerable populations.

Chi-Squared Analysis of association of observed and expected frequency of needs

	African American		Latino		Other		Total		
Service Needed	n	%	n	%	n	%	n	%	p-value*
Mental Health	298	63.7	137	29.3	33	7.1	468	100	<0.0001
Education	137	56.9	80	33.2	24	10.0	241	100	<0.0001
Employment	165	72.1	44	19.2	20	8.7	229	100	0.009
Housing	158	58.7	83	30.9	28	10.4	269	100	0.002
All Clients	2096	64.0	743	22.7	489	14.9	3274	100	

Poster # 126

TRAUMA READMISSIONS IN THE UNITED STATES: AN INVESTIGATION OF THE NATIONAL READMISSION DATABASE

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Introduction: Rates of trauma readmissions and risk factors for readmission across the United States has not been well studied to date. The recent release of the National Readmission Database will allow for more detailed analyses on trauma readmissions. Our aim was to analyze the National Readmission Database for trauma readmissions to find patterns and risk factors for readmissions.

Methods: We used the 2013 National Readmission Database from the Healthcare Cost and Utilization Project. We included all admissions with a primary diagnosis of trauma and linked all readmissions, regardless if to a different hospital, to the first admission. We excluded all patients younger than 18 years and weighted the data per the National Readmission Database protocol. We performed univariate and multivariate regression analyses to determine if readmissions were associated with patient characteristics, hospital characteristics, injury characteristics, and outcomes.

Results: The database captured a total of 35,580,348 admissions in 2013, 14,325,172 (40.2%) had a primary diagnosis of trauma. Of these, 3,814,170 (26.6%) experienced one or more readmissions to any hospital within a one year period. The longer the length of stay, the higher likelihood of readmission (p=0.000). Those aged 75-85 years had higher rates of readmission compared to all other age groups (p=0.000). Hospitals in an urban setting had higher rates of readmission compared the rural setting (p=0.000), as did patients who were discharged home (p=0.000). Private hospitals had higher rates of readmission, compared to government (p=0.000). Injury severity score 15-26 is also associated with higher rates of readmission. There was no significant difference in readmission with median household income (p=0.6).

Conclusions: Readmissions after trauma are common across the United States and with the recent release of the National Readmission Database, this study is the first of its kind to assess nationwide readmission rates and risks in more detail. Our study highlights that private hospitals and those in urban areas have higher rates of readmission. The reasons for these differences requires further research.

Poster # 127

HELMETS MATTER: KENTUCKY MOTORCYCLE CRASHES SEEN AT A TENNESSEE TRAUMA CENTER

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Introduction: Motorcycle crashes have increased nationwide since the mid-1990s. Motorcycle helmet laws vary by state with Kentucky requiring helmets only for younger riders. A Tennessee Level 1 trauma center catchment area includes southeast Kentucky and southwest Virginia. We hypothesized that motorcyclists injured in Kentucky and seen at a Tennessee trauma center would more likely be unhelmeted, have more severe head and neck injuries, and be fatalities than those injured in Tennessee or Virginia.

Methods: A Trauma Registry review of 729 injured motorcyclists from January 2005 through June 2015 examined state location of accident, demographics, helmet use, markers of injury severity, operative procedures, lengths of stay, and clinical outcomes. Multivariate logistic regression analysis controlling for gender, injury severity, and comorbidities evaluated predictors for head and neck injury severity and death with $p< 0.05$ significant. Current state motorcycle helmet laws were reviewed.

Results: Unhelmeted motorcycle rider status predicted more severe head and neck injuries [relative risk 15.3, 95% confidence interval (CI) 1.5-1.9, $p<0.01$] and death [relative risk 4.2, 95% confidence interval (CI) 0.04-0.1), $p<0.01$]. Motorcyclists injured in the state of Kentucky and seen at a Tennessee trauma center were more likely to be unhelmeted ($p<0$ .05), require an operative procedure ($p< 0.05$), have more severe head and neck injuries ($p< 0.05$), have longer lengths of stay ($p<0.05$), and be fatalities ($p<0$ .05) than motorcyclists injured in Tennessee or Virginia. Motorcycle fatalities from Kentucky were younger and included more females than those injured in Tennessee or Virginia ($p<0.05$).

Conclusion: This single trauma center study lends support for maintaining and enforcing current universal helmet laws for motorcycle riders of all ages in states where they are in effect and highlights the need to upgrade helmet laws that apply only to some riders. Injury prevention efforts may include lobbying policy makers and safety advocates in the home state and in surrounding states to upgrade and enforce motorcycle helmet laws.

Poster # 128

MAINTAINING COMBAT READINESS OF ACTIVE DUTY ARMY SURGEONS

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Introduction: During the last 14 years, the military has been engaged in combat operations in the Middle East. Wartime casualty survival rates are the highest they have been in history. The unprecedented combat casualty survival is multifactorial and has resulted from multiple advances in the spectrum of battlefield care: from evacuation; to changes in transfusion practices; to improvements in protective body armor and vehicles. While not easily quantitated, the role of the combat surgeon is also fundamentally important to the improved survivability. Of the branches of the military, the US Army has the largest deployable surgical force. The purpose of this study was to examine the future readiness of Army surgeons. We evaluated deployments, surgical training, pre-deployment training, caring for trauma patients while not deployed, as well as comfort with deployment and trauma relevant surgical skills. We hypothesized that over the last 14 years, Army surgeons have developed 'combat trauma readiness' secondary to recurrent and multiple deployments and subsequent to this operational tempo, Army surgeons have maintained clinical readiness in combat-relevant trauma skills.
Methods: A detailed, voluntary and anonymous online survey was sent to active duty deployable Army surgeons. Questions were asked about surgery training, trauma experience, deployments, pre-deployment training, comfort with deployment-relevant trauma-skills, and perceived preparedness for deployment. Aggregate data were shared with military leadership, but all responses remained anonymous. The outcome measure of 'trauma readiness' was defined by: evaluating comfort with combat-trauma relevant procedures; comfort taking care of trauma patients; and readiness to deploy. Multivariate regression analysis was used to determine predictors of comfort with trauma care and ANOVA testing was used to compare trauma relevant procedure comfort amongst cohorts with different numbers of deployments; *p*-values were considered significant at $p < 0.05$. **Results**: 168 Army surgeons received surveys and 152 responded (91%). 46% of respondents reported that they cared for trauma patients on at least on a monthly basis. Multivariate predictors for surgeon comfort with trauma and performance of trauma operative skills included frequent deployments and caring for trauma patients while not deployed; these were statically significant ($p<0.05$) when adjusting for age, rank and pre-deployment training courses. At the time of their first deployment, 53% of surgeons were within one year of completing their residencies. 44% had deployed only to Forward Surgical Teams (Role 2), 39% deployed to both Role 2 and Role 3 (Combat Support) Hospitals, while 8.5% deployed only to the Role 3. 62% of Army surgeons did not attend surgery-relevant pre-deployment training prior to their first deployment and, for those who had pre-deployment training, it did not affect measures of 'trauma readiness' on univariate or multivariate analyses. **Conclusion**: Given the limitations of self-reporting, this analysis indicates that Army surgeons are comfortable caring for trauma patients and feel prepared to deploy. At the time of this survey almost, all of the respondents had deployed to a combat zone; however, the majority did not take care of trauma patients while not deployed. Thus, it appears that the combat operations and frequent deployments have been a powerful engine for trauma skills sustainment and readiness; however, as the deployment tempos decrease, future efforts should consider exploring supplemental and unique training platforms for continued readiness capabilities.

Poster # 129

CAN FIREFIGHTERS BE TAUGHT ULTRASOUND?

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Introduction: There are many reports of paramedics using prehospital ultrasound but there are no reports of its use by firefighters. The purpose of this study was to evaluate the feasibility of training firefighters to perform and transmit ultrasound in the field.

Methods: This prospective, IRB approved study involved three fire departments in which 54 firefighters were trained to use E-FAST[DT1] in the field. The firefighters went through a didactic session that reviewed the science of ultrasound, ultrasound technology and its indications. This session was followed by a practical training session in which they learned how to do the E-FAST exam. Next, each firefighter had to do at least 100 E-FAST scans on "normal" individuals and send those scans electronically to the proctor. The firefighters then underwent a written exam followed by a practical exam. The same proctor administered both exams.

[DT1]Define E FAST here Extended Focused Assessment With Sonography for Trauma

Results: All 54 firefighters passed the written exam with the lowest score of 84%. They all also passed the practical exam with no one requiring any further training. Passage of the practical exam included showing proficiency in doing the E-FAST as well as transmitting the data electronically to the hospital and hospital practitioner.

Conclusion: All the firefighters learned the skill of E-FAST and were able to transmit to the hospital. Even one year after the start of the trial, the firefighters have maintained their proficiency and have diagnosed not only pneumothorax, but also liver laceration in a 9 year old boy. This study shows that it is feasible to teach firefighters to do the E-FAST and be able to transmit the images to the hospital and providers.

Poster # 130

CT SCANS SHOWING CORONARY ARTERY CALCIFICATION IDENTIFIES PATIENTS AT RISK FOR MYOCARDIAL INFARCTION IN THE SETTING OF TRAUMA

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Background: A myocardial infarction (MI) occurring in the setting of recent traumatic injury can be a very serious and deadly complication. In recent years, cardiac gated CT scans have gained popularity as a non-invasive technique for predicting the risk of future cardiovascular events. With this technique, the amount of coronary artery calcification (CAC) is quantified and helps to accurately predict a future risk of MI. The association between incidentally noted CAC on CT scans obtained during trauma evaluations and risk of in-hospital MI has not been studied. Our hypothesis is that MI increases after trauma in those patients who have CAC seen on CT scan.

Methods: In a multi-institutional study involving three Level 1 trauma centers, we performed a seven year retrospective review (2007-2013) of all trauma patients greater than 55 years of age with a chest CT and diagnosis of in hospital MI. These cases were matched 2:1 with trauma patients without MI, by age and gender. Variables evaluated included previously identified coronary risk factors (hypertension, diabetes mellitus, dyslipidemia, current smoking and BMI) and CT findings of pulmonary artery enlargement, mild and severe coronary calcification, cardiac enlargement, and valvular calcification. Predictors of MI were assessed using conditional logistic regression. Data are presented as medians with interquartile ranges and odds ratios (OR) with 95% confidence intervals.

Results: Fifty-eight patients over age 55 with MI and a chest CT were identified. The majority (59%) were male, the median age was 80 (74, 86) years and median ISS of 17 (4,50). Univariable analysis confirmed that MI was associated with HTN (75% vs 56% p=0.02), smoking status (64% vs 35%, p<0.01), history of diabetes (35% vs 18% p=0.02), prior cardiac surgery (30% vs 15%, p=0.03), and severe coronary calcification (64% vs 44%, p=0.05), Fig 1. Multivariate analysis performed on the cardiac risk factors and on the radiologic risk factors was performed. Smoking (OR 3.65 (1.46, 9.10), p=<0.01), diabetes (OR 3.23 (1.07, 9.74) p=0.03) and severe coronary calcification (OR 2.20 (1.02, 4.71), p=0.04) were independently associated with an increased risk of MI.

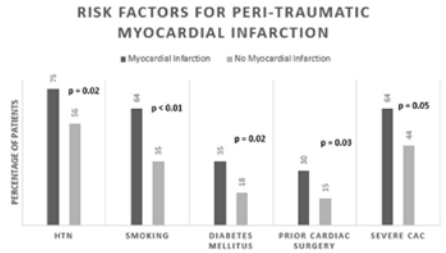


Fig 1

Conclusion: Coronary artery calcification on admission trauma chest CT is independently associated with an in hospital risk of MI after traumatic injury. Trauma patients who are found to have CAC should receive additional cardiac evaluation and treatment to prevent this potentially deadly complication.

Poster # 131

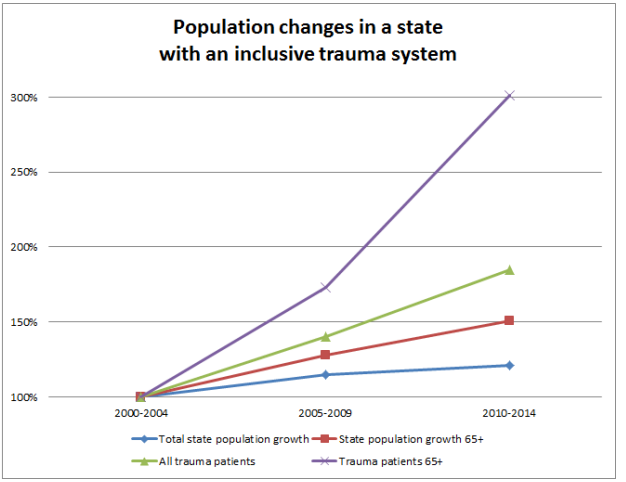
INJURY IN THE ELDERLY: A BURDEN ON AN INCLUSIVE TRAUMA SYSTEM

Emily E. Murphy MD, Glen H. Tinkoff* MD, Maxwell A. Braverman DO, Mark D. Cipolle* MD, Ph.D., MarySue Jones RN, Kevin M. Bradley* MD, Christianacare Health Services

Introduction: The geriatric population is the fastest growing trauma population in the US. The elderly present a unique challenge to trauma systems due to their comorbidities and frailty. We sought to assess the impact of geriatric trauma on an inclusive trauma system since it's inception.

Methods: Our state trauma registry was queried for all patients aged 65 and older from 2000-2014. Data was divided into three five-year cohorts and groups were compared for demographic and outcomes variables. A combination of US census data and state data was used to compare general population changes with changes in the trauma population. Chi-squared test was performed on categorical variables. Continuous variables were compared with Kruskal Wallis and reported as median and interquartile range.

Results: During a 15 year period, 80,850 patients were cared for in an inclusive trauma system. 21,241 were 65 years and older. The proportion of trauma patients 65 years and older increased from 19.5% (3,699/19,017) in 2000-2004 to 24.1% (6,398/26,580) in 2005-2009 and 31.6% (11,144/35,253) in 2010-2014 (p<.001).



The total state population at the end of 2014 was 121% of the 2000 population. This rise was 151% for those 65 and older. While a general and significant increase in the total trauma population (185%) was noted during this time, visits by patients 65 and older in the 2010-2014 dataset were 301% of those in the reference set. Despite the two-fold increase in geriatric trauma patients, mortality of these patients decreased from 6.6% (n=243) in 2000-2004 to 5.2% (n=332) in 2005-2009 to 3.5% (n=391) in 2010-2014 (p<.001). Median injury severity score was 9, though interquartile range varied among groups. Length of stay also decreased from 5 days (3-8) in 2000-2004 to 4 days (3-6) in 2010-2014 (p<.001).

Conclusions: Trauma evaluations of elderly patients increased at twice the rate of the general population. Despite the increasing burden of geriatric trauma, care in a maturing inclusive trauma system was associated with decreased mortality and length of stay.

Poster # 132

THE PRICE OF ALWAYS SAYING YES: A COST ANALYSIS OF SECONDARY OVERTRAIGE TO AN URBAN LEVEL I TRAUMA CENTER

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Introduction: Level I Trauma centers serve as a community resource with documented survival advantages for a variety of critical injuries. Most centers generally employ an inclusive transfer acceptance policy that may result in overtriage of patients with minor injuries, particularly in rural environments. The financial burden that this imparts on an urban trauma system has not been well examined. We sought to examine the incidence of secondary overtriage (SOT) at an urban Level I trauma center as well as the financial cost associated with SOT.

Methods: This was a retrospective registry study from an urban Level I trauma center examining patients admitted as Trauma Transfers (TT) from 2010-2014. Demographics, injury characteristics, and interventions were collected in addition to hospital charges. SOT was defined as patients not meeting "Orange Book" transfer criteria and that had a hospital length of stay (LOS) of < 48 hours. Average Emergency Department (ED) and transport charges were obtained during the study period to allow for calculation of total transfer charges.

Results: A total of 2,678 TT were treated over the 5 year interval. The number of TT increased yearly over the study interval. Mean age of TT was 59.7 years (SD ± 27.1), patients were predominantly male (58.2%) Caucasians (82.7%), with at least one comorbidity (71.7%). Medicare (35.7%) and Private (33.9%) insurance were the predominant payor source. Blunt trauma accounted for 97.1% of admissions with a Median ISS of 9 (IQR 5-16). Predominant injuries were isolated Closed Head Trauma (59.6%), skin/soft tissue (19.2%), and spinal injury (17.2%). SOT was 53.7% overall and increased yearly ($p < 0.001$). SOT patients were significantly younger (54.4y vs. 66y, $p < 0.001$) had a lower median ISS (9 vs. 13, $p < 0.001$),less likely to require any intervention (1.9% vs. 27.3%, $p < 0.001$), and more likely to be discharged directly home (78.8% vs. 43.7%, $p < 0.001$) than those with justifiable transfers. Median trauma center charges for SOT patients were ($27,028 IQR $19,410-34,899) while ED charges were ($40,440 IQR $26,150-65,125) resulting in a total cost of $67,468/patient.

Conclusion: A liberal TT policy results in a high SOT rate at our urban trauma center adding significant unnecessary costs to the healthcare system. Collaborative efforts to establish effective transfer guidelines may allow for significant cost savings without compromising care.

Poster # 133

STAY LOCAL: RURAL TRAUMA CENTER DESIGNATION REDUCES NEED FOR PATIENT TRANSFER

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Introduction: Development of rural Level III trauma centers in a regionalized system may improve patient outcomes through improved early stabilization and prompt critical interventions. In addition, the resources to admit more patients to level III centers may benefit the patient as well as the trauma system by reducing the burden of inter-facility and, in our case, inter-island transfers. However, the impact on patient outcomes must be assessed. We hypothesized that the development and designation of Level III centers in an inclusive trauma system resulted in lower rates of transfer to higher level center, with no increase in morbidity or mortality among the non-transferred patients.

Methods: State trauma registry data from Jan 2009 through Sept 2015 were examined from 5 rural hospitals that transfer patients to our highest Level II urban hospital. These 5 rural hospitals began receiving state support in 2010 to develop their trauma programs and were subsequently verified and designated Level III centers (3 in 2011, 2 in 2013). Multivariate logistic regression was used to examine the adjusted odds of patient transfers or adverse patient outcomes, while controlling for patient age, gender, penetrating versus blunt mechanism, presence of a general head injury or traumatic brain injury, arrival by ambulance, and category of injury severity score. The study period was divided into “Before” rural Level III center designation (2009-2010), and “After” (2011-2015).

Results: A total of 7,445 patient records were included. There was a significant decrease in the proportion of patients who were transferred After (1,277/5,701) compared to Before (516/1,744) periods. While controlling for the above covariates, the odds of patient transfer were reduced by 34% ($p<0.0001$) during the After period. Among non-transferred patients, there were no significant differences in adjusted odds of mortality, or hospitalizations of seven days or more, Before versus After.

Conclusions: Development of rural Level III trauma centers in a regionalized system can significantly reduce the need for transfer to a remote, higher level trauma center. This may benefit the patient, family, and trauma system, with no adverse effect upon patient outcome.

Poster # 134

UTILITY OF THE MODIFIED EARLY WARNING SCORE FOR INTERFACILITY TRANSFER OF PATIENTS WITH TRAUMATIC INJURY

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Introduction: The modified early warning score (MEWS) is a "track and trigger" score based on standard physiologic vital signs. The objective of this study is to determine if the MEWS can be utilized by the receiving facility for predicting short-term clinical outcomes and secondary overtriage, or by the transferring facility for predicting optimal transport mode, risk for deterioration, and need for interventions in transit.

Methods: Included were all consecutively admitted trauma patients transferred into a level II trauma center in 2013 and 2014. Pre-transfer MEWS and decrease in MEWS in transport (MEWS deterioration) were calculated for each patient. Data were abstracted from the hospital's trauma registry and the EMS charts from the three leading agencies. Outcomes included mortality, complications, ICU admission, operative status, transport mode, MEWS deterioration, secondary overtriage (ISS ≤ 9, LOS ≤ 1 day, and discharge home), and in-transit event (interventions, complications, and change in vital signs in transit). We analyzed study outcomes using receiver operator characteristic (ROC) curves and ANCOVA.

Results: There were 652 transferred patients. The mean pre-transfer MEWS was 1.8 (1.2), and was missing in 11% of patients. Overall incidence of outcomes is shown in table 1. After adjustment, mean pre-transfer MEWS was positively associated with the following outcomes: mortality (expired, 3.94 vs. survived, 1.55, $p < 0.001$); ICU admission (admitted, 1.98 vs. not, 1.62, $p < 0.001$); complication (yes, 2.04 vs. no, 1.77, $p=0.04$); operative procedure (yes, 1.87 vs. not, 1.58, $p=0.046$). and transport mode (Air 2.3 or CCT 3.0 vs. ALS 1.6 or BLS 1.3, $p < 0.05$ for all comparisons). The mean pre-transfer MEWS was not significantly associated with secondary overtriage (yes, 1.66 vs. no, 1.84, $p=0.13$) or in-transit event (2.04 vs. 1.62, $p=0.08$). These findings persisted when examining the change in MEWS during transport for study outcomes. ROC analysis is shown in table 1 and demonstrates a pre-transfer MEWS < 4 had a specificity for survival of 94% and non-ICU admission of 97%.

Table 1. Pre-transfer Modified Early Warning Score (MEWS) ROC curve analysis

Outcome	Event %	AUROC (95% CI)	P value	Criteria	Sensitivity	Specificity	PPV	NPV
Mortality	6.6%	0.73 (0.69 – 0.76)	**< 0.001**	≥ 4	51%	94%	39%	96%
Complication	15.5%	0.56 (0.52 – 0.60)	0.07	≥ 4	16%	93%	29%	86%
ICU admission	50.6%	0.57 (0.53– 0.61)	**0.002**	≥ 4	14%	97%	83%	53%
Operation	32.9%	0.52 (0.48– 0.56)	0.33	≥ 2	51%	54%	35%	69%
Secondary overtriage*	21.8%	0.54 (0.50 – 0.58)	0.16	≤ 1	58%	49%	24%	81%
Helicopter transport	18.4%	0.62 (0.58 – 0.66)	**< 0.001**	≥ 2	64%	56%	25%	87%
MEWS Deterioration	22.6%	0.59 (0.55 – 0.63)	**0.001**	≤ 1	63%	50%	27%	82%
In-transit event**	16.9%	0.61 (0.52 – 0.69)	0.07	> 1	56%	62%	23%	87%

*secondary overtriage: ISS ≤ 9, LOS ≤ 1 day, and

**In-transit event: intervention, complication, change in vital sign, procedure in-transit from

Conclusion: The pre-transfer MEWS can be utilized by the receiving facility for predicting in-hospital mortality and for allotment of OR and ICU resources, particularly scores ≥ 4. The pre-transfer MEWS appeared to be less useful for the sending facility in identifying appropriate transport mode and risk for deterioration and in-transit events during interfacility transfer.

Poster # 135

WHO ADMITS SEVERELY INJURED TRAUMA PATIENTS? REVIEW OF 201,636 PATIENTS IN A POPULATION-BASED DATASET

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Introduction: Severely injured trauma patients ("ISS>15") are generally thought to require admission to Level I or II trauma centers (I/II TC). Few national data exist to confirm whether this is occurring. The objective of this study was to determine where these patients are admitted.

Methods: Adult "ISS>15" were selected from the 2012 National Emergency Department Sample. After excluding ED deaths, transfers, and discharges, we examined where "ISS>15" patients were admitted: I/II TC vs "OTH" (all others). Weighted descriptive analysis examined demographic and clinical characteristics. Multivariable logistic regression was used to predict "OTH" admission, adjusting for patient and hospital characteristics.

Results: Of 201,636 severely injured ED visits, 76,305 (37.8%) were evaluated in "OTH" with 1,059 (1.4%) ED deaths, 22,794 (29.9%) transfers and 15,008 (19.7%) ED discharges. 37,445 (49.1%) were admitted to "OTH" with 2,855 (7.6%) deaths and 1,848 (4.9%) eventually transferred to another hospital. Among the admitted, the odds of "OTH" admission were higher in women (OR=1.19; 95% CI=1.11-1.27), those covered by Medicare (OR=1.61; 95% CI=1.32-1.96), or uninsured (OR=1.53; 95% CI=1.14-2.05) compared to private insurance, and older age (85+ years had OR=2.61 (95% CI=1.98-3.44) compared with 16-25 years). Median income of zip code and region of country were not significantly associated with "OTH" admission while having multiple injuries was associated with decreased odds of "OTH" admission (OR=0.58; 95% CI=0.50-0.67).

Conclusions: Half of severely injured individuals presenting to "OTH" were admitted to "OTH" (19% of all ISS>15). Odds of "OTH" admission were higher in women, older individuals, Medicare insured, and the uninsured while the odds of "OTH" were lower in multiple trauma. Further research is needed to confirm these findings and determine why certain groups are more likely to be admitted to a facility incongruent with their injury severity.

Poster # 136

TRAUMA PATIENTS: "I CAN'T GET NO (PATIENT) SATISFACTION?"

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Introduction: The Center for Medicare and Medicaid Service (CMS) provides financial incentives to hospitals based on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction survey. Trauma patients are a unique population who are typically cared for by multiple services that potentially impact patient satisfaction. Trauma patients are traditionally viewed as having a negative impact compared to other groups on overall hospital patient satisfaction. Recent studies have shown patient satisfaction is impacted by the willingness of a physician to fulfill the patient's demands irrespective of its medical necessity, and the physician's ability to provide a favorable prognosis. Here we present the first study to specifically evaluate trauma patient satisfaction and hypothesize it will compare negatively to overall hospital patient satisfaction scores.

Methods: Three different analyses were performed. Group 1 was composed of **ALL** patients (trauma/non-trauma) admitted to our hospital over an 18 month period who were administered a validated patient satisfaction survey by a 3rd party (**ALL**). Group 2 compared admitted trauma patients, identified by trauma specific ICD-9 diagnosis codes (**ICD**), to identify disparities as they relate to diagnosis/prognosis. Group 3 consisted of the three Level I Trauma Centers in our area (**TC**). Patient satisfaction data of trauma vs. non-trauma patients (**ALL**), trauma specific diagnoses (**ICD**), and HCAHPS associated satisfaction across Level I facilities in our area (**TC**) was analyzed using the appropriate statistical test. A data mediated model for adjustment of patient satisfaction was developed to account for differences in prognosis in the **ICD** group.

Results: In the **ALL** group, no differences in satisfaction were noted in 18/21 questions for trauma patients when compared to non-trauma patients at our hospital. Patient satisfaction in the **ICD** group was worse in patients who carry a diagnosis of spinal cord injury compared to other trauma diagnoses. To adjust for **ICD** associated poor satisfaction, a complexity matrix was developed to allow comparisons across hospitals of varying injury severity and volume. Log transferred patient satisfaction scores in relation to complexity was found to have a strong polynomial fit of R2 0.5833. No difference was found in HCAHPS associated satisfaction between the three Level I Trauma Centers in our area (**TC**).

Conclusion: In contrast to the commonly held opinion, trauma patients do NOT negatively contribute to patient satisfaction in our facility. Certain injuries may offer opportunities for improvement. Our data demonstrate the current model of patient satisfaction is impacted by the prognosis and our risk adjusted model is the first to potentially balance for poor patient satisfaction due to **ICD** associated prognosis. In the era of public reporting and financial penalties, surgeons should embrace patient satisfaction as it may be vital to the survival of the trauma center.

Poster # 137

STATEWIDE ANALYSIS SHOWS COLLABORATIVE REGIONAL TRAUMA NETWORK REDUCES REGIONAL MORTALITY

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Introduction: Regional Trauma Network (RTN), composed of one level I and several lower level trauma centers (TCs) across multiple hospital systems, was established in 2010. This collaborative network utilized a unified triage protocol and a single transfer center. The impact of RTN was assessed by evaluating regional mortality changes before and after RTN establishment.

Methods: Patients in the state trauma registry with age ≥ 15 from 2006-2012 were analyzed; 2006-2009 and 2010-2012 were designated as pre-RTN and RTN periods respectively. Region was defined as a county containing level I TC (L1TC) and its adjacent counties. Any counties bordering multiple L1TC-containing counties were excluded from analysis. Mortality was compared for all regions before and after RTN implementation. The following subgroups were also included *a priori* for the comparison: Injury Severity Score (ISS) ≥ 15, age ≥ 65 , and trauma mechanisms.

Results: 121,448 patients were analyzed; 66,977 and 54,471 patients were in the pre-RTN and RTN groups, respectively. Mean age was 58; 90% had blunt injuries. The overall mortality was 4.9%. Mortality comparisons over time for all regions are shown (Table 1). Additionally, RTN region was also the only region in the state that had mortality reduction in all patient subgroups. After adjusting for age, ISS, level of TC that performed treatment, and trauma mechanism, RTN implementation was an independent predictor of survival (odds ratio: 0.876; 95% CI: 0.771-0.995, p=0.04, c-statistic: 0.84).

Table 1

Region	Pre-RTN		RTN		
	deaths	total	deaths	total	p-value
A	891 (5.3%)	16927	701 (5.2%)	13516	ns
B	415 (5.2%)	7928	372 (6.5%)	5716	**0.001**
C	278 (3.2%)	8725	285 (4.6%)	6214	**<0.001**
D	462 (4.5%)	10266	365 (4.0%)	9223	ns
E	363 (5.5%)	6548	305 (5.4%)	5624	ns
RTN	886 (5.3%)	16583	610 (4.3%)	14178	**<0.001**

RTN: reginal trauma network; ns: non-significant

Conclusion: RTN region was the only region in the state that had mortality reduction in all analyzed patient groups and RTN implementation was an independent predictor for survival. These suggest that regional collaboration and network-wide, uniform triage practices should be key components in the development of regionalized trauma networks.

Poster # 138

TRAUMA SURGEON TO PATIENT RATIO IMPACTS OUTCOMES AT HIGH VOLUME TRAUMA CENTERS

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Introduction: Several studies have examined the relationship between trauma center volume and outcomes. None of the previous studies have examined if the number of trauma surgeons in relation to trauma center volumes contributes to trauma center outcomes. The goal of our study was to examine the relationship between trauma center volume and number of trauma surgeons and outcomes.

Methods: The National Trauma Databank was abstracted for all patients (≥ 18 years) treated at high volume trauma centers (≥1200 annual admissions) from the years 2011 and 2012. Patients who were dead on arrival and those with missing data points were excluded. Each center's annual volume of trauma admissions and number of trauma surgeons were used to create ratios. Multivariate regression analysis was performed for mortality after controlling for patient (age, gender, ISS, hemodynamics, GCS, emergent need for OR, insurance status) and hospital (level of designation, volume, trauma surgeon to volume ratio) characteristics to determine the most appropriate number of trauma surgeons.

Results: A total of 95,073 trauma patients from 30 centers were included. Mean age was 43 ± 18 years, 70.7% were male, and median [IQR] ISS was 9 [4-16]. The median number of trauma surgeons to volume was 0.0049 [0.0043-0.0064] which equates to a median of 1 trauma surgeon for every 205 trauma patients annually. The number of trauma surgeons to volume ranged from as low as 1 trauma surgeon for every 555 patients to as high as 1 trauma surgeon for every 105 trauma patients. 50% of trauma centers has less than 1 trauma surgeon for 205 trauma patients annually. Overall mortality rate was 3.2%. Multiple regression analysis revealed that patients treated at centers with a trauma surgeon to volume ratio of greater than 0.0025 had lower odds of mortality. This ratio equates to 1 trauma surgeon for every 400 trauma admissions annually. Patients treated at these centers had 23% lower odds of mortality (OR, 0.77; 95% CI, 0.66–0.91) than patients who are treated at centers with a lower trauma surgeon to volume ratio.

Conclusion: Trauma patients who are managed at centers that have a higher number of trauma surgeons relative to overall trauma admissions have better outcomes. At least 1 trauma surgeon for every 400 trauma patients maybe required to achieve optimal outcomes. This finding may provide additional information for trauma centers to obtain appropriate resource to adequately staff trauma centers.

Poster # 139

ALTERNATIVE PAYMENT MODELS: CAN (SHOULD) TRAUMA CARE BE BUNDLED?

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Introduction: Recent legislation repealing the Sustainable Growth Rate mandates gradual replacement of fee for service with alternative payment models (APM), which will include service bundling. We analyzed two years' experience at our state designated LI trauma center to determine the feasibility of such an approach.

Methods: De-identified data from all injured patients treated by the trauma service during 2014 and 2015 were reviewed to determine individual patient injury profiles. Using these injury profiles we created the "trauma bundle" by concatenating the highest AIS for each of the six body regions to produce a single "signature "of injury by region for every patient. These trauma bundles were analyzed by frequency over two years and by each year. The impacts of physiology and resource consumption were evaluated by determination of correlation of the mean and standard deviation of calculated survival probability (Ps) and ICU stay (ICU LOS) for each profile group occurring more than 12 times in two years.

Results: The 5813 patients treated over two years produced 858 distinct injury profiles, only 8% (69) of which occurred more than 12 times in two years. Comparison of 2014 and 2015 profiles demonstrated frequency variation among profiles between the two years. Analysis of injury patterns occurring >12 times in two years demonstrated an inverse correlation between mean and standard deviation for Ps (R2=0.68) and a direct correlation for ICU LOS (R2=0.84).

Conclusion: These data indicate that the disease of injury is too inconsistent a mix of injury pattern and physiologic response to be predictably bundled for an APM. The inverse correlation of increasing SD with increasing LOS ICU and decreasing Ps suggest an opportunity for measureable process improvement.

Poster # 140

DOUBLE JEOPARDY: OUT-OF-HOSPITAL AND INTER-HOSPITAL UNDERTRIAGE TO DESIGNATED TERTIARY TRAUMA CENTERS AMONG INJURED OLDER ADULTS – A 10-YEAR SPATIALLY-ADJUSTED STATEWIDE ANALYSIS.

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Introduction: Out-of-hospital under-triage of older adult trauma patients to designated tertiary trauma centers has long been acknowledged. Transporting patients directly from scene to a Level I/II trauma center may be considered optimal but for predominantly rural regions where there may be need to travel long distances to a tertiary trauma center, trauma system effectiveness in improving outcomes may be largely predicated on rapid identification at the initial facility and transfer of patients requiring a higher level of trauma care. This study sought to determine the adjusted odds of treatment at a tertiary trauma center (TTC) for older adult trauma patients overall, from the scene of injury and via inter-hospital transfer from a non-tertiary trauma (NTTC) center.
Methods: This was a retrospective cohort study utilizing data from a statewide trauma registry reported over a 10-year period (2005-2014). Patients were excluded if they were 16 years old or younger (n=17498), had burn related injuries (n=1880), were transferred to or from an out-of-state hospital (n=15581). The outcome of interest was treatment at an ACS or state-designated tertiary trauma center (Level I/II). The predictor variable of interest was age group, dichotomously defined as older adult (age >=55 years) or young adult (age < 55 years). Covariates of interest included patient demographics, injury etiology, overall injury severity and by body region, physiology, transport mode, other clinical characteristics and distance measures. ArcGIS (ESRI) was used to geocode patients' injury location and to calculate driving distances from injury scene to designated trauma hospitals. Multivariable analyses were performed using logistic regression.
Results: 84 930 patients met study criteria. Of these 42% (35659) were aged 55 years and older with an average age of 74 years (SD, 11.6). Compared to their younger counterparts, older adult patients were significantly ($p < 0.05$) more likely to have severe (AIS >=3) head and extremity injuries, have pre-existing comorbidity and had a slightly lower average ISS (10.7 vs 11.5). No significant differences were noted in the average distance from the scene of injury to the closest trauma facility (any level), however, older adult patients were on average, injured slightly farther away from a TTC (47 vs 44 miles, $p<0.001$). Overall, disproportionately fewer older adult trauma patients were treated at a TTC (42% vs 65%). Although there was no difference in the rate of transfer by age group among patients initially presenting to NTTCs, older adult trauma patients were significantly more likely to be transferred to a NTTC (53% vs 34%). After adjusting for confounders and other predictors (including, distance measures and body region injured), older adult trauma patients were less likely to be treated at TTCs overall (OR=0.54, 95% CI: 0.52-0.56), whether transported by EMS from the scene of injury (OR= 0.47, 95% CI: 0.44-0.50) or via inter-facility transfer (OR= 0.63, 95%CI: 0.59 – 0.68).
Conclusion: Despite evidence demonstrating reduced mortality when treated at TTCs, older adult trauma patients face significant under-triage to such hospitals by EMS and via transfer from NTTCs. If outcomes in this high-risk population are to be improved, evidence-based geriatric-tailored pre-hospital and inter-facility trauma triage guidelines are urgently needed.